SOUTHWESTERN JOURNAL OF ANTHROPOLOGY

Published by the University of New Mexico
with the Laboratory of Anthropology, Santa Fe,
in the interest of general anthropology

VOLUME 12 • NUMBER 3 • AUTUMN • 1956

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UNIVERSITY OF NEW MEXICO
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The Southwestern Journal of Anthropology is designed to include articles in all branches of anthropology relating to peoples and cultures, past and present, in any region. It is offered as a vehicle of expression for anthropologists in all parts of the world.

Manuscripts and other editorial materials should be addressed to the Editor, Leslie Spier, University of New Mexico, Albuquerque, New Mexico.

Subscription: $4.00 a calendar year (single number, $1.00). Foreign subscription, 1 £ sterling or its equivalent in local currency. Subscriptions should be sent to W. W. Hill, University of New Mexico, Albuquerque, New Mexico. (Remittances should be made payable to the Southwestern Journal of Anthropology.)

Issued in quarterly numbers: Spring, Summer, Autumn, Winter of each year.

Indexed in the *International Index to Periodicals*

Microfilm copies of whole volumes of the Southwestern Journal of Anthropology may be purchased for permanent files by libraries and other subscribers from University Microfilms, 313 N. First Street, Ann Arbor, Michigan, to whom inquiries should be addressed.

Printed at the University of New Mexico Printing Plant.

Entered as second-class matter June 17, 1947, at Albuquerque, New Mexico, under Act of Congress of July 16, 1894.

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OF ANTHROPOLOGY

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SOME ASPECTS OF THE QUANTITATIVE APPROACH IN ARCHAEOLOGY

ROBERT F. HEIZER AND SHERBURNE F. COOK

ARCHAEOLOGISTS have mainly concerned themselves with the qualitative aspects of their science. They have been interested in those manifestations of art, religion, and general culture which furnish clues to the kind of civilization, the modes of thought, the manual skills, the customs, the emotions of the people. At the same time there has been displayed a rather unfortunate neglect of purely quantitative information, based upon the examination and study of very ordinary and frequently obscure material archaeological residues. The exploitation of this resource can lead, and already has led, to significant new advances in knowledge concerning material living conditions and environmental relationships characteristic of cultures whose subjective and qualitative features have previously been exhaustively explored. We believe that it will be of interest to those concerned with all phases of extinct human culture to review briefly but comprehensively the progress which has been made and to indicate certain untested lines of approach which might be explored in future with profit.[1]

The basic tenet underlying the quantitative analytical approach is that any entity is a potential source of knowledge which can be expressed in numerical terms. The principle applies to both tangibles and intangibles. However, since the most immediate applications have hitherto been made with respect to the former, the present discussion will be largely confined to the purely material aspects of the subject.

Tangible entities are taken to include anything and everything which can be

1 The authors have carried out this work with the support of the University Committee on Research and the Wenner-Gren Foundation for Anthropological Research and through the agency and facilities of the University of California Archaeological Survey (Berkeley).

apprehended by the human senses or which, through direct manipulation or indirect instrumentation, can be counted, weighed, or measured. If this premise is accepted, the enormous scope of the method of attack is readily apparent, for no material relict of a former population can be discarded as irrelevant. In the examination of every town, village, habitation site, trash heap, burial site, temple, pyramid, cave, camp site, or garden plot, nothing can be overlooked. Everything, no matter how unpromising on first sight, may perhaps be utilized. Each component must be given careful scrutiny for it may have a new story to tell.[2]

The actual methods to be adopted will vary with the nature of the material. These techniques will range from painfully simple to exceedingly complex, from linear measurements with ruler or tape to intricate analyses with expensive instruments. All the archaeologist needs to do, however, is decide what determination ought to be made. If he cannot perform it himself he can normally find someone who can do it for him. The important step is the recognition of the opportunity.

The procedures and techniques necessary or available fall into four general categories. The first is direct mensuration, usually based upon significant geometrical patterns and involving distances, areas, and volumes. The second is mechanical, or physical, analysis, requiring most frequently the counting or weighing of specific components of a deposit with subsequent calculation of total quantities. This category differs from the next in that the individual items concerned are large enough to be handled separately, or at least macroscopically. The third category is chemical analysis, applicable to a great array of substances in soil, bones, products of industry, and the like. The fourth category is on quite a different level and in one sense includes all the preceding. It pertains to the statistical handling of the data derived from physical or chemical analyses.

Archaeologists and physical anthropologists have always been interested in securing *mensuration* data: such as the dimensions of artifacts, buildings and towns, etc., or the precise shape and size of human bones.[3] Indeed, in the field it is routine procedure for the excavator to draw a very exact map of the site with which he is concerned and to plot and record the precise location of all strata and artifacts encountered. On the other hand, there are additional uses for certain of these data which have not always been sufficiently exploited.

Areas are integral data for the computation of population densities and distributions, since by definition density is the number of individuals per unit area. Several applications of this principle have already been made in studies on Cali-

2 Cf. Rowe, 1953, p. 923.

3 Of relevance here is the additional matter of what Angel (1952, pp. 265, 268) calls the "social biology" of skeletal materials, when he infers a variety of cultural practices and life conditions in an extinct population.

fornia prehistory. Thus many of the discussions of population with reference to habitat which are found in Kroeber's *Handbook of the Indians of California* are based upon areal considerations.[4] Indeed, Kroeber was one of the first to modify the concept of area so as to utilize a single dimension such as a stream-mile, or a unit distance along the coast line, as representing an occupied surface. Cook and Treganza[5] demonstrated a logarithmic relationship between the area of California habitation sites and the number of occupants. The same type of relation may also be discovered in other parts of California (e.g. among the Yurok on the Klamath River from data by Waterman[6]) and also among modern American cities (from data published by the United States Census Bureau). With reference to California, it is probable that profitable analyses could be made over larger areas by using such bodies of information concerning village sites as have been collected by Merriam for the Miwok of Mariposa County, by Gifford for the North Fork Mono and the Miwok of Tuolumne County, and Spanish explorer's records on the mainland Santa Barbara Chumash. Provided the total number of sites in an area is known and their place in the time scale can be ascertained, not only may the numbers and distribution of population be determined, but also inferences as to the economy, social organization, and settlement pattern may be drawn. Provided the ecological conditions have not materially changed during the period of human occupation in an area, the ethnographic record may prove extremely useful as a datum from which to project backward in time the nature of society and activity patterns. There is nothing new in this last idea — we are only suggesting that such analyses may on occasion be carried to further ends and refinements than has been attempted in the past.

On a wider scale, density studies based upon the measurement and ecological analysis of the area would well repay the effort if carried on in some of the regions of higher aboriginal cultures. The plateau of Central Mexico, for instance, offers a fine opportunity of this type, for it is a notable example of the delicate balance among population, subsistence, and habitation area. The beginning of such a study has already been made.[7]

Three dimensional geometry becomes of importance for the computation of volumes and masses. When it is desired to determine the total quantity of any particular component which occurs scattered throughout an accumulation or a structure, it is seldom possible to extract the component *in toto*. Sampling is therefore necessary and with it some estimate of the total amount of material from which the sample is taken. In handling the samples two alternative procedures are possible: to compute the quantity of the component as a function of weight or of

4 See also Kroeber, 1939.
5 Cook and Treganza, 1950.
6 Waterman, 1920.
7 Cook, 1949a, 1949b.

volume. If the first method is employed, then a mean density must be arrived at, and this in turn requires a figure for volume.

The calculation of the volume of a pyramid, of a building with rectangular cross-section, or of a hemispherical dwelling, is a perfectly straightforward matter. Usually, however, in archaeological work irregular masses are dealt with. Thus in California we have encountered almost exclusively habitation sites in the form of low mounds with no consistent pattern. No simple formula for deriving the volume of a regular body will fit. One must resort to approximations and must call upon his ingenuity in each case to discover the closest answer. We have found graphic projection to be a useful tool: the surface area and two cross-sections along perpendicular axes drawn to scale on coördinate paper will yield a result which is quite satisfactory, even if it includes an error greater than a statistician would like.

The decision whether to use weight or volume as a basis of reference must be decided for every class of material individually. If we are interested in the concentration of a micro- or chemical component, say for example calcium carbonate in habitation midden, we would express the result in terms of weight (percent, grams, or milligrams per kilo). Here the total size of the midden deposit is irrelevant. At the other extreme we might wish to discover how many artifacts of Type X could be found if the entire deposit was excavated. For this purpose the weight of the matrix is immaterial. Only the volume will yield the requisite information.

The *analysis of incidental physical remains* of materials of economic or industrial activity has been essayed by various students in the past. Earlier work in analyzing components of California shellmounds by Gifford, Loud, and Nelson was generally aimed at arriving at some age estimate of the occupation deposit.[8] Although detailed sampling and sorting of refuse constituents was done, relatively little ecological reconstruction was attempted. In recent years the general method of investigation in this sphere has been developed in the Departments of Anthropology and Physiology of the University of California, Berkeley campus.[9] The underlying reasoning presupposes that any tangible residues of human activity found in refuse or other deposits may be used as indices of the nature and extent or intensity of the associated activity. A familiar example is the collection and identification of animal bones from archaeological sites which yield information on the types of animals hunted and the relative abundance of particular species. Although most archaeological reports contain some information of this sort, the data are often presented most perfunctorily. Occasionally an archaeologist will attempt to infer more from the osseous remains than a catalogue of food animals.[10]

8 Gifford, 1916, 1949; Loud, 1918; Nelson, 1910.

9 Cook, 1950.

10 McGregor, 1941, pp. 255-260, 276-277; Hibben, 1937.

An initial study[11] explored the significance of the shell content of the San Francisco Bay shellmounds with respect to the food supply of the inhabitants. From this study it became evident that one might estimate not only the population but also the contributions of clams and mussels to their diet. Other components of habitation refuse, such as rock, various types of animal bone, charcoal, and obsidian chips in the aboriginal sites of California, also appeared promising subjects for investigation. The primary methodological problem appeared to be the adequacy of taking a limited number of fairly small samples from a site of relatively large dimensions. In order to secure a definitive answer to this and similar questions, Treganza and Cook[12] dissected and analyzed the entire small Peterson site (4-Sol-3), at the same time removing small samples of various types for comparison. The results established the fact that small sampling methods are adequate for the analysis and description of macro-components of habitation midden. Cook and Treganza[13] then extended the method to the comparative study of a series of sites extending from Mendocino County on the north through the Sacramento valley to Santa Barbara County on the south.

From the analyses of rock, bone, shell, and charcoal alone a great deal was learned with reference to the comparative ecology of the several principal areas concerned. Subsequently a similar study was made by Cook and Heizer[14] on a series of Indian mounds located along the Cosumnes River, together with the physical analysis of a dry-cave deposit from Amador County.

The analysis of bone (and shell) residues is of value primarily in evaluating the extent to which the extinct population was able to utilize animals as a source of food. The animal osseous residues are readily separable into the categories of mammal, bird, and fish. In many cases, but rarely in all, the species can be determined. However, great precision in the identification of species is seldom necessary, since a reasonable approximation is possible from average ratios of bone to body weight.[15] From an estimate of body weight the mass of flesh consumed can be computed. Finally if the population and the duration of occupancy can be ascertained, some estimate is possible of the dietary significance of the various types of animal food. A series of papers by T. E. White[16] — whose titles indicate the aim of throwing light on the aboriginal butchering techniques as inferable from careful study of the condition, body parts represented, and frequency of animal bones from archaeological sites — actually go far beyond this; and a considerable body of sound reconstruction of various cultural activities is presented. A detailed discussion of the methods of zoölogical identification of osseous re-

11 Cook, 1946.
12 Treganza and Cook, 1948.
13 Cook and Treganza, 1950.
14 Cook and Heizer, 1951.
15 White, 1953b.
16 White, 1952, 1953a, 1954, 1955.

mains, techniques for establishing the age and number of animals represented in a collection of archaeological bones, and of the cultural inferences which can be drawn from such data, has been published recently by Leroi-Gourhan.[17] Scattered in the literature[18] are brief communications on the cultural significance of zoölogical remains from sites, but it is clear that American archaeologists in general are not aware of the full possibilities inherent in careful study of such animal remains. A notable exception is the Iranian work of Carleton Coon.[19] The problem of whether or not a site was occupied by hunter-gatherers seasonally or throughout the year may often be settled by analysis of the zoölogical remains in the refuse deposits. H. Howard[20] was able to show clearly that the Emeryville shellmound on the shore of San Francisco Bay was inhabited the year round by demonstrating that the avifaunal remains included those of migratory species whose seasonal presence is recorded and that bird hunting was carried on throughout the year. Clark[21] summarizes a considerable body of European data on late glacial European sites (Ahrensburgian, Hamburgian, Magdalenian) which, from analysis of fish, bird, and mammal bones, can be shown to have been occupied either the year round, or only during certain seasons. In California the ethnographic record indicates that nearly all groups moved seasonally in order to exploit particular food resources, to escape winter snows or extreme summer temperatures in the lowlands, to avoid certain areas at the time of endemic disease peaks, and for other reasons. Many sites are therefore likely to have been occupied by the majority of the group for only part of the year, and this matter is probably subject to verification by careful analysis of residues of industrial and economic activity.

Additional data of interest can be obtained by observation of the relative quantities of mammal, bird, fish, and shellfish residues. It might be predicted in advance with some degree of assurance that the habitat of the aboriginal groups will show representation of its most prolific animal species in midden deposits. There is normally considerable correspondence between actual residues and animal distribution.[22] For instance, in the Cosumnes River mound series[23] the occurrence of salmon and its utilization as food could be demonstrated throughout the lower twenty-five miles of the river in a quite uniform manner. At the same time the

17 Leroi-Gourhan, 1952.

18 E.g., Allain, 1950.

19 Coon, 1951, 1952.

20 Howard, 1929, pp. 380-382.

21 Clark, 1952, pp. 25-28.

22 Not uncommonly bones of animals known to be native to the region will be lacking in refuse deposits. There will be several possible reasons, both ecological and cultural, which must be considered to explain such absences (cf. Gilmore, 1947, pp. 161-162). On fish remains see Miller, 1955.

23 Cook and Heizer, 1951.

residues from smaller fish characteristic of the lower river and sloughs progressively decrease in the sites upstream. Bird bone and mussel shell decline going up the river in a manner similar to many of the fish. However, mammal bone remains more or less constant, though with a perceptible shift from tule elk to deer. If necessary these secondary variations can be pin-pointed in space with a fair degree of exactitude.

Stratigraphic changes in the relative frequency of a specific animal residue in a refuse deposit are evidence of either (1) an increase or decrease in the animal population accessible in the environment or (2) an alteration in the culture such as to incorporate or eliminate the species as an item of diet. Which of the two alternatives is to be preferred can usually be determined by examination of other material remains. For example Greengo[24] shows that mussels and oysters were characteristic foods of the early shellmound dwellers of San Francisco Bay, but were largely ignored by the later peoples who ate the clam. The main cause for this change is attributed to availability of species which was affected by silting and by geological subsidence of the shoreline.[25]

It may be noted that efforts to reconstruct the dietary situation from archaeological residues will be made more difficult than they should properly be because of the practical absence of quantitative data in ethnographic accounts on this subject.

Another instance of cultural information obtainable from midden matrix pertains to rock. In many areas the country rock becomes incorporated in great masses in the mound, and has little cultural significance. In the delta of the Sacramento River, however, no rock is present in the soil and any found in habitation sites was brought in for a purpose. We have found[26] that every mound in the delta and lower river region contains at least four percent by weight of native rock or of baked clay balls and fragments. Four percent, then, represents an irreducible minimum necessary for domestic purposes (i.e. stone-boiling of foods). When the small rocks and pebbles to be secured from the nearby ground or stream beds was insufficient, artificial rock was resorted to. As a result we find the baked clay industry which was highly developed at site Sac-6 and other localities. Minute stone residues, we have noted, may yield important clues to certain industrial activities which might otherwise escape notice.

Of special interest is the deposit found in caves, like that analyzed by Cook and Heizer[27] from the central California rockshelter known as Bamert Cave (Site 4-Ama-3). This material has been preserved in a very dry condition throughout the decades since it was laid down. Much of the finer organic constituents

24 Greengo, 1951.
25 See also Greengo, 1954; Morrison, 1942.
26 Cook and Heizer, 1951.
27 *Ibid.*

which are still present in good shape would otherwise have been lost through decomposition. Here we were sufficiently fortunate to secure material from two spots close together, one inside and the other just outside the cave. It could be shown that the detritus was of substantially identical origin, but that the portion exposed to the rain, outside the entrance, had taken on the character of ordinary open-site refuse mound deposit whereas the portion protected in the interior had undergone little if any alteration. From an analysis of both portions two objectives were attained: first the type of activity carried on in the cave could be partially reconstructed and, second, the probable appearance and consistency of the average open site, in its pristine state, could also be reconstructed. Wood charcoal, commonly used for radiocarbon dating, can also be identified as to species, and inferences as to the variety and relative quantities of woods available can be deduced.[28]

The above examples do not exhaust the possibilities of the physical-analytical approach — for such classes of material as artifacts and potsherds have as yet scarcely been subjected to preliminary examination by the method. They may, however, indicate the manifold problems which are susceptible to attack by the method.

Various types of *chemical analysis* have been employed in the investigation of archaeological materials. Not only have man-made objects and human corporeal residues been scrutinized in this manner but also the very soil on which people have lived has been examined.

That man, living on circumscribed areas, tends to create and develop a soil with characteristics at variance with the natural surrounding terrain has long been appreciated by soil scientists. This peculiarity of the soil of habitation sites is also reflected in sharp vegetational differences — a point which has not been missed by botanists and plant ecologists. Unfortunately, however, these biologists have given the problem relatively little systematic attention, thus leaving wide open a very attractive field of research. Drucker[29] proposed that variations in vegetation cover on archaeological sites might have chronological significance. Nelson[30] was able to show that on sites in the Galisteo Basin, New Mexico, cactus *(Opuntia)* is characteristically present on later sites but is lacking on earlier ones. Iversen[31] finds that on sites of Mesolithic age in Denmark certain plants, notably *Chenopodium* and *Urtica*, are characteristic. Apparently the soil chemistry retains distinctive features over very long periods of time. There is little doubt that rough local relative chronologies could be worked out on the basis of floral assemblages associated with sites.[32]

28 Maby, 1932; Muller-Stroll, 1936.
29 Drucker, 1943, pp. 114-115.
30 Nelson, 1914, pp. 81, 87, 96.
31 Iversen, 1949, p. 9.
32 Cf. Bank, 1953.

Soil analysis on the chemical level may be of importance in two respects. In the first place, it may eventually yield clues bearing upon the secular evolution and hence the age of the deposits. Although this line of investigation has not been carried very far, preliminary work done in the Department of Soils on the Berkeley campus of the University of California by H. Jenny, F. Harradine, and J. Setzer have indicated that under the climatic conditions of central California, at least, progressive movements of solutes occur in Indian mounds. These movements result in vertical variation in such factors as lime content and pH, and lead to such obvious structural changes as hardpan formation. If these chemical shifts could be tied to a secure time scale, we should have a completely new method for dating.

In the second place chemical analysis can indicate comparative differences in sites of approximately the same age horizon. For purpose of orientation a series of simple tests was performed by Cook and Treganza[33] on two San Francisco Bay area sites: 4-Sol-3, a typical late culture inland mound, and 4-Ala-309, a bayshore shell mound. The pH, the content of $CaCO_3$ and the level of organic carbon were found to be very different in the two locations. Although the authors did not attempt to explain these differences, it was evident that these reflected ecological factors and might furnish indices to the manner of life of the inhabitants.

A more extensive series of tests was carried out by José Setzer under the direction of Prof Hans Jenny of the Department of Soils. A set of standard soil analyses was performed, according to stratigraphic level, on several mounds in the lower Sacramento valley. All the principal recognized culture periods were represented: Early, Middle, and Late. Within each age group differences in carbon, nitrogen, and other constituents were found. These differences could be related to stratigraphic levels within a single mound and also to each mound as a whole. This work has not been published, and is clearly a long way from being complete. Nevertheless the results make it evident that an extensive quantitative soil study of archaeological habitation sites is in order. It has been established that phosphoric acid accumulates in soils of archaeological sites as a result of the deposition over a long time of organic materials. Such phosphate concentrations will, in general, be higher in sites occupied by hunter-gathering peoples whose living debris and trash consists of large quantities of animal and plant wastes.[34] Attempts to establish rates of soil development have been made by Li, Siniaguin, Sokoloff and Carter, and Sokoloff and Lorenzo.[35]

An entirely different chemical approach has been the analysis of fossil bone.

33 Cook and Treganza, 1947.
34 Dauncey, 1952, pp. 33-36; Lorch, 1939.
35 Li, 1943; Siniaguin, 1943; Sokoloff and Carter, 1952; Sokoloff and Lorenzo, 1953.

The main objective of these studies has been the establishment of a scale of time, so that the bones might be placed with reference to their age. Nevertheless the method may be utilized for developing information concerning environmental conditions in the past.

The origin of the technique may be ascribed to Middleton and Carnot[36] who subjected many archaeological, but even more paleontological, specimens to analysis for their content in fluorine. The theory was that one of the hydroxyl radicals in the apatite lattice in the bone is lost and a fluorine atom gained during long sojourn in the soil. After Carnot little further activity was seen in the field until the work of K. P. Oakley beginning in 1947.[37] Meanwhile there had been developed on the Berkeley campus of the University of California methods for the analysis of several other components of fossil bone. These included particularly nitrogen, organic carbon, and water. In a series of papers[38] results were reported which showed beyond reasonable doubt that there occurs a progressive reduction in these components with age as the bone lies in the soil. However the age determinations are disturbed because of the variation in environmental circumstances, for the reactions by which the organic portion is slowly dissipated depend upon the hydrogen concentration, the moisture, and the temperature. It follows that the intensity of these, and many other factors, should be followed throughout the history of the burial site — a truly formidable, and as yet unsolved, problem. As examples of the significance of the soil and climatic factors may be cited the following: bones from Arizona and New Mexico sites which have been preserved in a relatively dry (and hence chemically inactive) condition appear younger, according to chemical analysis than known contemporary material from central California. This is consistent with the fact that the reactions concerned are accelerated by moisture. At the opposite extreme comparable material from the eastern United States (Kentucky and New York) appears older than would be expected, due to the generally moister climate.

An instructive example of a different type is provided by the osseous material from the Topanga site in Los Angeles County, California (site 4-LAn-1). Bone from the majority of central and northern California mounds is heavily calcified; the content of carbonate is abnormally high. In fact so universal is this phenomenon that the generalization is permissible that bones buried in any genuine habitation midden accumulate carbonate. Now the carbonate analysis for the Topanga site showed a definitely subnormal value for this component. The explanation

36 Middleton, 1844; Carnot, 1893.

37 Oakley, 1951.

38 Cook, 1951a, 1951b; Cook and Heizer, 1947, 1952, 1953a, 1953b; Heizer, 1950, 1953; Heizer and Cook, 1949, 1952.

appeared to be that the Topanga village site was located on the summit of a low knoll or ridge. After deposition the material residues were subjected to a long-continued downward seepage of water, which carried the lime always away from the human deposit. At the sites in the valleys and other flat-lands of the state there has been an annually alternating rise and fall of soil water (accompanying the wet and dry seasons) which has resulted in an accumulation, rather than a leaching of lime.

These examples of anomalies in the dating of fossil bone are mentioned in order to set forth and stress the fact that a dating system is not the only legitimate objective of the chemical analytical method. For this method may be utilized not only with the soil but also with the interred bone, in order to obtain information concerning the past history of the site itself. This procedure has not been seriously exploited hitherto but it remains a valuable tool for future investigation, particularly if it can be combined with some independent device for establishing chronology.

For pure dating and chronology, there exists at present no method which can approach in validity the analysis for radiocarbon. It would be superfluous here to attempt a review of the work of Libby and his colleagues. The statement should be made, however, that the carbon 14 method for establishing dates, in spite of occasional aberrant results and of a persistent minor error, stands as the supreme example of the application of rigid physical reasoning to a rather fuzzy science.

The several papers published by the present authors dealing with the chemical analysis of archaeological or fossil bone contain numerous citations to papers by other workers investigating inorganic (including fluorine) and organic components of bone. We take this opportunity to cite additional papers of significance on this subject. On the microscopical analysis of archaeological bones, see Rivière; Morgenthaler and Baud; Baud, Durif and Morgenthaler; Barbour; Grossjean and Périer; Graf; Ascenzi; and Schaffer.[39] On chemical analysis to determine the amount of ossein, fluorine, calcium carbonate, etc., see Milne-Edwards; Scheurer-Kestner; Rivière; Koby; Bayle, Amy and du Noyer; Tanabe; and Hamaguchi and Tatsumoto.[40]

Various other and less productive applications have been made of chemical methods to archaeological problems. For instance the problem of patination has long been intriguing. Indeed a rather extensive literature has been built up dealing with various aspects of the phenomenon and the following references are given as

39 Rivière, 1905; Morgenthaler and Baud, 1953; Baud, Durif, and Morgenthaler, 1954; Barbour, 1950; Grossjean and Périer, 1939; Graf, 1949; Ascenzi, 1956; Schaffer, 1889.

40 Milne-Edwards, 1860; Scheurer-Kestner, 1870a, 1870b; Rivière, 1892; Koby, 1938; Bayle, Amy and du Noyer, 1939; Tanabe, 1944; Hamaguchi and Tatsumoto, 1950.

examples: Hue, Hunt, Gehrcke, and Heizer.[41] What is pertinent here is the attempt to evaluate the age of a mineral or metallic object by means of the thickness of the patinated layer, for the thickness is susceptible to accurate measurement.

The most promising material for this purpose is flint or chert which develops a white, opaque patina. It was shown by English investigators that the chemical alteration necessary to produce this layer requires an alkaline medium. In our laboratory we tested a long series of flint chips from artifacts from Texas, furnished by Dr Cyrus Ray of Abilene. We were able to patinate fresh surfaces at will, using either heat or alkali or a combination of both. At a high temperature and with a pH equivalent to normal NaOH we could secure a patina of archaeological thickness in a few days. However, the calculated number of years to produce this change at ordinary ambient temperatures and soil alkalinities was entirely fantastic. We concluded that the type of imitative experiment we had performed did not correctly represent the environmental conditions to which the flint artifacts had been subjected, and that a great deal more study was indicated. However, these investigations are in their infancy and subsequent attempts at a solution of the problem, if they are conducted upon a rigid physical and chemical basis, are very likely to be successful.

Pottery has already been discussed with reference to fragmentation, potsherds, and population. Chemically pottery has long been of interest with respect to the nature of the components of which it is made. Particular emphasis has been placed upon the properties of the clay from which the utensils are made and on the paint with which they are decorated. Most of this work has had a purely qualitative objective — what kind of clay or paint. However, the technique could easily be employed in a quantitative manner, and the objective could be shifted to consider the number and the mass of pots manufactured from specific materials or treated in a particular way. On a comparative basis, from site to site, or region, such an approach might prove very productive.

The *statistical problem* connected with this type of archaeological research resolves itself into a study of frequencies of occurrence. It should be clearly borne in mind that the statistical treatment is merely a means to an end. It is never an end in itself. Consequently the simplest methods are always to be recommended and any attempt to complicate the procedure by stressing interest in the theory of mathematical statistics is to be deprecated.

Another point which should be recognized by both investigators and editors of manuscripts is that we are not dealing with an *experimental* but with an *observational* field. We cannot set up a pretentious "experimental plan" as so many statisticians, who know so little science, advocate. We have to take the material which

41 Hue, 1929; Hunt, 1954; Gehrcke, 1933; Heizer, 1953.

is given to us, as it is, and make the best of it. It is quite to be expected that the limits of accuracy are at best fair, at worst poor. But shall we discard the whole effort to learn something, because we cannot learn all? Shall we disdain fifty percent accuracy because we cannot, in the nature of things, achieve one hundred percent accuracy? The answer to these questions is based upon simple common sense.

The practical problem which confronts any worker in the field of quantitative archaeology is twofold; how many samples should be taken, and how large should be each sample. The answer must be given in each particular case, and with reference to the kind of material which is being investigated.

The size of the individual sample must bear a direct relationship to the size of the material in which interest is centered. Thus, for chemical constituents enough for an analysis is sufficient, and this may be a very small quantity. For physical constituents the volume of mound matrix or soil must be adequate to contain the unit particles concerned: a small volume for minute particles, a large volume for coarse material. Thus for shell fragments a few cubic centimeters might suffice, whereas if one were sampling the occurrence of human burials several cubic meters might be necessary.

A special problem arises when the raw material is passed through a screen or sieve in order to isolate the fragments which are desired. If a coarse screen is used, many fine pieces may be lost and go unrecorded. On the other hand, if a very fine screen is employed the labor of sorting and counting may be utterly excessive. We have sought and found a valid and useful compromise. We screen much material with a coarse screen. Some of the material which passes is again screened, this time with a fine screen. Then if enough material has been thus treated, a ratio may be established from which the probable frequency of the fine fragments may be calculated from the siftings through a coarse screen. It is only necessary that the standard errors of estimate be reduced to a reasonable value.

The number of samples taken from the original sources must be neither too small nor too great. If there are too few — for example, two or three — it will then not be possible to employ the ordinary methods of small sample statistical analysis. The distribution of all discrete particles, or fragments, varies within any deposit of detritus within wide limits. Hence the sample number must reach the absolute minimum of ten and should reach at least twenty. Additional samples improve the analysis up to the point where labor, time, and expense become of transcendent importance. In an attempt to assess the significance of sample number, Treganza and Cook[42] excavated an entire habitation mound and counted the

42 Treganza and Cook, 1948.

total number of fragments and weight of rock, bone, shell, charcoal, and obsidian chips in the mound. There was no question of statistical proportions here. This was the answer, complete and unequivocal. However, in the process of excavation, a good series of small *samples* was taken (113 in all). Finally the results of complete excavation were compared with those derived from the samples when it was found that the same result was reached by both methods. This experiment — for it was an experiment — proved that sampling yields reliable results. The number of samples (113) in this instance was, of course, more than is usually needed. However, the general procedure was fully validated.

In conclusion it should be emphasized that quantitative examination and analysis of human residues of any description have the potentiality of producing valuable information concerning two broad fields of interest. In the first place there is an association with ecology. The types of animals and plants represented and, more important, the numbers and quantities of animal and plant remains show the relation between a human civilization and the physical world on which it was dependent. In the second place, the culture itself, through such physical or chemical remains as calcium carbonate, potsherds, or burials can be assessed in terms which permit an evaluation of the culture, and furnish a means of comparison with other cultures in other geographical areas.

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ACOMA KINSHIP TERMS

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EGGAN HAS DESCRIBED the Acoma kinship system as formerly of the Crow type, similar to that of Laguna, with a probable shift to a "bilateral" system, in which father's sister is classed with mother and cross-cousins with siblings.[1] The greatest changes in classification have occurred in connection with the father's lineage group, but, although maternal relatives are still classified in terms of a lineage principle, these too are beginning to shift.[2] He found that the system is (or once was) characterized by patterns of alternation of generations and verbal reciprocity.[3]

During a one-month stay at Acoma in September, 1954,[4] the writer collected kin terminologies from two informants, one a man, the other a woman. Differences between these two lists, and between these and the three previously published lists,[5] upon which Eggan based his reconstruction, suggest a need to reëxamine the available data with a view to separating the discrepancies due to errors in, or incompleteness of, data from those due to changes in the system or to contemporary variants. In this paper it will be demonstrated that failure to recognize the importance of speaker's sex and failure to distinguish between terms of address and terms of reference had obscured several instances of terminological classification in some of the earlier data. A number of Eggan's reconstructed terms for matrilineal relatives, female speaker, were corroborated by the new data, indicating that, with regard to these relatives, the older system is still in use, at least by some speakers. However, the system given the present writer by a man for his matrilineal relatives is sharply bilateral, suggesting the presence of contemporary variants in kinship classification. Two instances of a change to bilaterality emerge: one involves the classification of cross-cousins; the other of the maternal uncle-nephew and the paternal aunt-niece relationships. Both are further demonstrations of the "probable shift to a 'bilateral' system" indicated by Eggan.

Terms of Address. The following is the list of Acoma terms of address collected from a male informant by the author in September 1954.

1 Eggan, pp. 237-238.

2 *Idem*, pp. 237, 238.

3 *Idem*, p. 228.

4 Funds, which were provided for this field trip by the Graduate School of Indiana University, are gratefully acknowledged.

5 Kroeber, pp. 83-87; Parsons, chart opposite p. 380; White, p. 40.

naiya	mother, father's sister, mother's sister
naištiya	father, husband's father, wife's father
nowɛ	father's brother, mother's brother
dyum^{a}	used by male speakers for: brother, father's brother's son, father's sister's son, mother's brother's son, mother's sister's son
jiji	used by male speakers for: sister, father's brother's daughter, mother's brother's daughter, father's sister's daughter, mother's sister's daughter; and by female speakers for: brother, father's brother's son, father's sister's son, mother's brother's son, and mother's sister's son
k?a'u	used by female speakers for: sister, mother's sister's daughter, father's sister's daughter, mother's brother's daughter, father's brother's daughter
na'na	used by male speakers for: father's father, mother's father, son's son, daughter's son
BaBa	used by male speakers for: father's mother, mother's mother, son's daughter, daughter's daughter; and by female speakers for: father's father, mother's father, son's son, daughter's son
dyiau	used by female speakers for: mother's mother, father's mother, son's daughter, daughter's daughter
mü't^{i}	son, brother's son, sister's son
ma'k	daughter, brother's daughter, sister's daughter
Biyɛ	female affinal relative
wa'ti	male affinal relative
sa'ok?	wife
sa'č	husband

The list given by a female informant during the same visit contained the following differences: in addition to the relatives listed above, the term *mü't*^{i} was used to address brother's daughter's husband, sister's daughter's husband, daughter's husband, and mother's brother. However, the informant also gave the general male affinal term as an alternate for all the affinal relatives listed. Mother's brother's wife was addressed as *naiya* (mother) or *ma'k* (daughter). Sister's son's wife was classed with daughter *(ma'k)*, and brother's wife with sister, female speaker *(k?a'u)*, but the term Biyɛ (female affinal relative) is an alternative for both. Father's brother was addressed by the same term as father *(naištiya)*. Mother's brother's daughter was addressed as *dyiau* (grandmother, grandchild, female speaker), and mother's brother's son as BaBa (grandfather, grandchild, female speaker).

Terms of Reference. Although the classificatory differences between our two informants were the same for terms of reference as for terms of address, both

used the same forms. Terms of reference used for the sibling class of relatives are morphologically unrelated to the corresponding terms of address. They are as follows:

saʿwatc	brother, both sexes speaking
šaʔu	sister, female speaker
saʿkuitc	sister, male speaker

In all other cases the reference term is formed by adding the prefix *saʿ (si)* to the corresponding term of address (i.e., *naʿna,* grandfather-grandson, male speaker, address; *saʿnaʿna,* grandfather-grandson, male speaker, reference; *naiya,* mother, address; *sinaiya,* mother, reference).

Comparison with lists of Kroeber, White, and Parsons. Neither Kroeber nor White recorded a distinction between terms of reference and terms of address. Kroeber's list is entirely made up of terms of address, although he suggests that a difference may have been elicited in two terms: *(s)atū* (husband) and *(s)auʾkwi* (wife). White's list includes our terms of address for the classifications of mother, father, brother, sister, grandfather, and grandmother; but he recorded our terms of reference for classifications of son, daughter, mother's brother-sister's son, cross- and parallel cousins, and female and male relatives by marriage. Since separate lists of terms of reference and address were not recorded, the classificatory identifications of sister with father's brother's daughter, father's sister's daughter, mother's brother's wife,[6] and mother's sister's daughter were obscured. He gives *tciʿtci (jiji),* our term of address, male speaker, for sister; but *sa kʾuitcʾ (saʿkuitc),* our term of reference, for the other four relatives listed. Both the 1954 systems show a form of White's sister-term as a classificatory term of address used for paternal cross- and all parallel cousins as well as for sister, and his term for paternal cross- and both parallel cousins and for mother's brother's wife as the term of reference for paternal cross- and all parallel cousins and for sister.

Confusion also results from lack of recognition of a distinction in speaker's sex for the classifications of siblings, grandparent-grandchild, and some other relationships. This error may arise from the use of a single informant. Kroeber recorded four sibling terms, recognizing the difference in sex of speaker, but he included, as Acoma-Laguna terms, some later recorded by Parsons as exclusively Laguna. His term for brother, male speaker, *tumūa,* is the term of address recorded in 1954 for that relative *(dyumᵃ);* and one of two terms recorded for sister, female speaker, *kaʾau,* is that recorded by the author for the same relationship. However, three other sibling terms — those for brother, female speaker, *(a)wa;*

6 Eggan believes White's listing of *sa kʾuitcʾ* for mother's brother's wife is an error (Eggan, pp. 228 and 357, note 13). Our female informant used *naiya* (mother) or *maʿk* (daughter), and our male informant *Biye* (female relative by marriage), for mother's brother's wife.

another form for sister, female speaker, *am;* and sister, male speaker, *(a)kwi*—were not recorded by either White, Parsons, or the writer for Acoma. But Parsons' list of Laguna terms includes *auwa* for brother, female speaker, and *akwi* for sister, male speaker. One of the three other terms listed by Kroeber but not appearing in later lists also shows up in Parsons' Laguna list: Kroeber (Acoma), *kuya,* father's sister, both sexes speaking, and brother's son and brother's daughter, female speaker; Parsons' (Laguna), *k'úya,* alternate term for father's sister (*naiya,* mother, is the more usual form), female speaker. Since Kroeber has combined the Acoma-Laguna terms into a single system, this discrepancy between his lists and those of other field workers may be explained in one of two ways: either the terms were once used at Acoma and have since been lost, or, contrary to Kroeber's assumption that the Acoma and Laguna have identical systems, they are specifically Laguna terms, and indicate a point at which the two systems did, and do, differ. The other two Laguna sibling terms, *gauau?,* sister, female speaker, and *t^{y}úme,* brother, male speaker, are the same as those recorded for Acoma. If we assume that Acoma once had these two terms and then replaced them with the self-reciprocal *jiji,* where did the term *jiji* come from? It seems more probable that in view of the importance of reciprocity in other terminological relationships, the self-reciprocal term belongs to the older system.

Kroeber's *am* (sister, female speaker), and two other terms, *awa* (child-in-law) and *kuwa* (parent-in-law) were not recorded by anyone else and do not appear in the Laguna system collected by Parsons.

With regard to the terms of the grandparent-grandchild relationship White recorded *na'na* for both grandfathers and for both daughter's and son's son; ʙaʙa^{a} for both grandmothers and both son's and daughter's daughter. The writer elicited the same terms *(na'na,* ʙaʙa*)* for the same relatives from a male speaker, but found that a female speaker uses ʙaʙa to address both grandfathers and son's and daughter's son, and another term, *dyiau,* to address both grandmothers and son's and daughter's daughter. Although Kroeber recorded only two grandparent-grandchild terms, he recognized the possibility of a distinction in sex of speaker: he noted that grandparent-grandchild terms were reciprocal, and that a female probably addressed all grandchildren, whether male or female, by the same term, and that males used a single, but different, term for all four grandchildren.

Comparison with Eggan's reconstruction. Eggan has reconstructed a matrilineal system indicating the reappearance of terms in alternate generations within a male ego's mother's matri-lineage. "In ego's own matrilineal lineage a man distinguishes his female relatives as 'sister,' 'mother,' and 'grandmother.' The term 'mother' is apparently used for alternate generations, since Parsons lists it for mother's mother's mother and for sister's daughter (male speaking)."[7] Dia-

7 Eggan, pp. 225, 227.

gram 1, herewith, based upon the system given the author by a male informant, differs from Eggan's Fig. 17[8] in three instances. Two of these, *ma·k* for sister's daughter, and *mü·t*^{i} for sister's son, break the pattern of alternate generations, placing sister's daughter and sister's son in a class with daughter and son, a more bilateral generation system, and pointing to a breakdown in the lineal system reconstructed by Eggan. The third difference is the replacement of the term *kuitc* (sister) by the term *jiji*, discussed above.

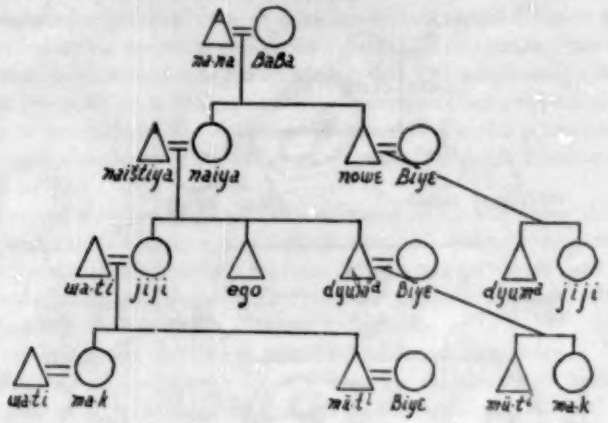

Diagram 1

On the other hand, our Diagram 2, based on the system given the author by a female informant, bears out Eggan's reconstruction in Fig. 18,[9] even to the extent of corroborating his expectation that a female speaker would use *mü·t*^{i} (son) to address her mother's brother, *nana*, her mother's brother's son, and *dyiau*, her mother's brother's daughter.

Indications of a shift to bilaterality. A comparison of the five lists reveals two cases which further illustrate a change in the direction of bilaterality. The first shift is concerned with the classification of paternal cross-cousins. Kroeber includes the male paternal cross-cousin (father's sister's son) in the terminological class with father, the female paternal cross-cousin (father's sister's daughter) in the terminological class with mother.

Contrary to this unilateral alignment, which further emphasizes a man's relationship to his father's clan, White, Parsons, and the writer found that sibling

8 *Idem*, p. 226.

9 *Idem*, p. 226.

terms were being used for all cross- and parallel cousins by male speakers, and for paternal cross- and all parallel cousins by female speakers, a generation alignment. Although Kroeber's list does not include terms for the maternal cross-cousins or for either set of parallel cousins, he stated that "the uncle and aunt and nephew and niece terms were given by the Acoma informant as applying to 'identical' or 'parallel' as well as to 'cross' relatives; but he further insisted, and my Laguna authority corroborated, that the terms father, mother, son, and daughter were also employed for both the cross and parallel relationships of this class. . . ."[10]

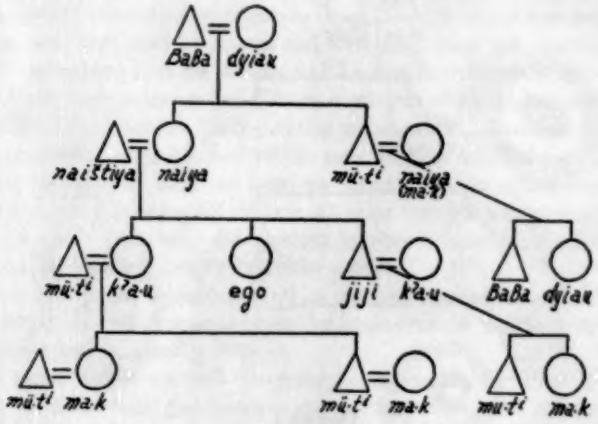

Diagram 2

While this passage does not shed light on the problem of cousin classification, it suggests that a generation type of classification was used, at least as an alternative form, for parents' and children's generations. Whether or not a similar alternative existed for ego's generation, is, unfortunately, not stated. Although Kroeber did not give terms for the matri-cross-cousins, Eggan postulated that these should be designated by the grandparent-grandchild terms by a female speaker, and by the son and daughter terms by a male speaker.[11] When asked for these terms, our female informant responded with: "Let me see, that would be my grandson [or granddaughter]" and gave the terms accordingly. Our male informant, however, insisted upon brother-sister terms for the matri-cross-cousins, as well as for the patri-cross- and both sets of parallel cousins. Parsons also recorded this straight generation system. White recorded son and daughter terms for the matri-cross-

10 Kroeber, p. 84.

11 Eggan, p. 226, Figs. 17 and 18.

cousins, but sibling terms for other cousins. This is particularly interesting since the reciprocal relationship to father's sister's son is mother's brother's son, and of father's sister's daughter is mother's brother's daughter. Hence, reciprocally, if father's sister's son (male speaker) is designated "father" as Kroeber recorded it, mother's brother's son (male speaker) should be designated "son" as White recorded it.

It may be concluded that (1) there was (and is) a difference between cousin designations for speakers of different sex; (2) that formerly a reciprocal parent-child classification prevailed between cross-cousin designations for male speakers; (3) that formerly a reciprocal grandparent-grandchild classification prevailed between cross-cousin designations for female speakers, and is still being used today; and that (4) while some vestiges of this old system still exist, there is a growing tendency to reclassify all first cousins as siblings, and that this generation system was, perhaps, already being applied as an alternate form when Kroeber recorded his list in 1917.

The second shift has to do with the self-reciprocal classifications of mother's brother with sister's son, *nawi*, and father's sister with brother's daughter, *kuya*, listed by Kroeber. White recorded the same classification for the mother's brother-sister's son relationship *(sa nawɛ)*, but found that father's sister was addressed as *naiya* (mother), and brother's daughter, reciprocally, as *sa maʻkˀ* (daughter). One of our informants, the woman, also retained the self-reciprocity of the terms for mother's brother and sister's son. However, she did not use the term, *nowɛ*, for any relative, but classified both mother's brother and sister's son with the son group *(mūʻtˡ)*. Our male informant, however, used the term *nowɛ* to address mother's brother, but reported the term for the son group, *mūʻtˡ*, for sister's son, male speaker. Eggan has suggested that the terms for mother's brother may differ with speaker's sex: "White gives *sa nawe* for mother's brother but does not differentiate male and female speakers. Parsons omits the term from her chart but gives 'mother' as the term for the reciprocal: 'sister's daughter (male speaking).' This suggests that the correct term [for a female speaker] may be *s'amuiti*, 'son,' which is also the Laguna pattern."[12] However, while our female informant gave *mūʻtˡ* for mother's brother, our male informant gave, not the reciprocal *naiya* for sister's daughter, but *maʻk*, daughter. The former is the missing term reconstructed by Eggan, but the reciprocal, sister's daughter, male speaking, reported by Parsons and from which he made his reconstruction, has fallen into disuse, at least by some speakers. Instead, the sister's daughter is classed, generation-wise, with daughter and brother's daughter by speakers of both sexes.

It is interesting to note that the male informant also used *nowɛ* to address his father's brother, while this relative is listed by White, Kroeber, and Parsons in

12 *Idem*, p. 228.

the father class. The male speaker designates father's sister as *naiya* (mother) and brother's daughter as *ma'k* (daughter), as recorded by White.

In this case, as in that with the cousin-sibling group, the shift is clearly in the direction from a unilateral toward a collateral alignment by male speakers. This is probably due in part to the influence of the Spanish and American systems, and in part to the gradual disintegration in importance of the matri-clan and matri-extended family.

Conclusions. The foregoing analysis suggests a general trend toward greater bilaterality and less emphasis on unilateral lines. However, conclusions concerning actual changes in terminological classifications of kin are rendered tenuous by inaccuracies in the early lists due in large part to a confusion of distinctions depending upon speaker's sex and upon reference and address. On the one hand, a number of Eggan's reconstructed terms, particularly with regard to the system for female speakers, are borne out by the new data, further strengthening the unilateral aspects of the system; on the other, a number of cases seem to indicate a slow shift from unilaterality to bilaterality in the form of a generation-type classification.

Further evidence for a breakdown in the unilateral system may be inferred, with caution, from the inability, or unwillingness of informants to supply either terms or genealogical data more removed than the grandparental and grandchild generations and their descendants. It was usual for informants to supply names, kin terms, clan affiliations, etc. for primary relatives of mother and her parents, but to "not know" anything about even the primary relatives of father, or about the descendants of primary relatives of mother. Whether they did not know, or wanted to cut short the interview is a moot point, but the situation did recur with a number of informants.

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SOME EASTERN NEPALESE CUSTOMS: THE EARLY YEARS

VICTOR BARNOUW

IN A PREVIOUS ARTICLE I described some marriage customs of the Jimdārs or Rais, with special attention to the pattern of individual courtship, in which respect the eastern Nepalese apparently differ from their neighbors — the Tibetans, Lepchas, western Nepalese, and the Indians of Bengal — who generally have arranged marriages.[1] In the present article I will describe the phases of the Jimdār life cycle which precede marriage. The data presented here are based primarily on interviews with a single informant and secondarily on some observation of children's play in Darjeeling, West Bengal, in January-March 1953.[2] My informant, Kolsing Rai, was a reliable, intelligent Jimdār in his forties, the father of twelve children — and consequently in a good position to know

1 Victor Barnouw, *Eastern Nepalese Marriage Customs and Kinship Organization* (Southwestern Journal of Anthropology, vol. 11, pp. 15-30, 1955).

Since writing this article I have learned that courtship practices are also current among the Tibetans. According to most of the early literature, arranged marriages are the norm in Tibet (Sarat Chandra Das, *Marriage Customs in Tibet,* Journal, Asiatic Society of Bengal, vol. 1, pt. 3, pp. 6-31, 1893; Ekai Kawaguchi, *Three Years in Tibet,* Madras, 1909, pp. 351-355; Charles Bell, *The People of Tibet,* Oxford, 1928, p. 175 ff.). The same picture is presented in a recent book, *Tibet and the Tibetans,* by Tsung-Lien Shen and Shen-Chi Liu (Stanford, 1953, pp. 144-145). Kawaguchi writes that until the very day of the wedding the bride and groom know nothing of the marriage, or each others' names, and are brought face to face for the first time on the wedding day (*op. cit.,* p. 355). Although Sir Charles Bell also describes marriages as being arranged by the parents, he makes this qualification: "The practice of young men choosing their own brides is growing; it is commoner among the peasants and the traders than among the landed gentry" (*op. cit.,* p. 175). In his recent book Heinrich Harrer observes: "In former times marriages were arranged by the parents, but today the young people choose their own partners" (*Seven Years in Tibet,* Dutton: New York, 1954, p. 197). I have been told by Robert and Beatrice Miller that among the Tibetans of the area around Kalimpong and Darjeeling marriages are arranged by parents in upper class families, while individual courtship is current among the lower classes. "Even among upper-class families individual courtship often obtains. At the present time [as of 1954-55] marriages among upper-class families, other than officials, in the Darjeeling District were not strictly arranged by the parents (except marriages of state). Even where the marriage was pre-arranged, the element of courtship was to be found frequently. The less influential families played even a lesser role, and courtship was more the mode" (Personal communication). It is possible that there may also be regional and class variations among some of the other groups, such as the Bengalis. Further research should clarify these problems.

2 Darjeeling is heavily populated by Nepalese, most of whom are Jimdārs; and although they have taken over some Bengali, Tibetan, and Western customs, they still retain much of the traditional eastern Nepalese culture.

something about childhood customs and child rearing patterns. I present this material for publication, despite its deficiencies, because much of the information is not available elsewhere, and because I believe it to be correct in essentials.

Some Jimdār customs suggest that children are welcomed. A characteristic blessing at the First Feeding and Haircut ceremonies, to be described below, is "May you have many children!" My informant said that large families are desired, even though the problem of feeding so many mouths may be difficult. Birth control practices are unknown, except perhaps among a very small minority.

During pregnancy a woman is not supposed to remain idle but should, in fact, do more work than usual. She is expected to continue carrying loads until the time of confinement, for in this region most of the pack-carrying (of wood, provisions, etc.) is done by the women. Her husband is not allowed to kill any animals during this time, not even insects, if he can help it. It is believed that breaking this taboo would endanger, not the child, but the mother, and would cause difficulties at the time of birth, an act of retribution by the gods.

The woman should keep her mind on fortunate and auspicious things, should remain as frank and generous as possible, and should give alms to beggars who come to the door. She should avoid looking at strange ill-omened sights such as a lunar eclipse. She should not cut fruit lengthwise — only crosswise. Nor should a pregnant woman make the mistake of stepping over the tumpline *(nāmlo)* used in carrying burdens. Such actions are believed to cause difficulties in labor.

Some pregnant women carry charms to ward off dangers. Among such charms is the *jantar*, a list of *mantras* or prayers on a piece of paper which is folded, tied with a thin thread, and attached to a string worn around the neck. Two different kinds of religious specialists prepare charms of this type upon request. The *bijuwā*, a sort of shaman, writes spells and verses designed to please the ancestors of the family, who may otherwise be wrathful. The *jotishī*, a Brāhman astrologer, may draw a picture of some important planets and inscribe a prayer to counteract adverse astrological influences.

Pregnant women are said to have certain food preferences — particularly for sour foods such as a local variety of rhubarb, and *pamalo*, a fruit somewhat like grapefruit.

As the time of childbirth approaches, only a few relatives are allowed in the expectant woman's home — her mother or mother-in-law, perhaps, together with the midwife. The husband stays close at hand, but does not enter the room while labor is in progress. No non-relatives are admitted inside the house at this time, for fear of the evil eye.

The period of labor is said to be often quite short — an hour or so, an easy birth being attributed to the hard work done by the woman during the past

months. During labor the woman generally removes all of her ornaments, necklace, *jantar*, earrings, nose-ornaments, etc. This is thought to remove obstacles to the birth, after which they may be put on again.

Although there is a general preference for boys, it is usually a matter for rejoicing if the *first* child is a girl. This is because large families are characteristic of this area, and if the oldest child is a girl, she will be able to help her mother look after the younger ones.

To have twins of opposite sex, a boy and a girl, is considered very unfortunate. It is believed that they were probably husband and wife in a former incarnation. No misfortune, however, is associated with having twins of the same sex.

As soon as a child is born, the father kills a fowl of some kind, not as a sacrifice, but as food for the mother. If the child is a boy, he kills a cock.

Meanwhile, the baby's umbilical cord is knotted and cut, and the placenta taken away to some hidden place. It is put into an old jar or tin can and stuck in the fork of a tree, where insects cannot reach it. If the child should later develop sores on its body, people will say that the placenta has been bitten by insects.[3]

Back in the home, both mother and newborn child are now bathed and rubbed with mustard-oil. This treatment will be given the child almost daily in the months to come, for mustard-oil is believed to provide protection against the cold. The oil is carefully smeared over the child's eyes and also in his ears and navel. This is thought to prevent the eyes from watering, while the pressure applied to the navel is meant to keep it from bulging. Mustard-oil massage of this type is always performed close to a small charcoal brazier where a warm fire is burning; then the child is wrapped up snugly.

On the first day, after mother and child have had their bath, the mother may eat the meal prepared for her. This consists of the recently killed fowl and some highly spiced curry and rice, with a generous helping of thin gravy. For beverage there is a seasoned brew prepared from millet known as *kodo*.

Since birth makes the house impure, no one will visit it for a while, nor will the mother go out until after the naming ceremony has taken place.

NAMING CEREMONY

Among some Nepalese groups, an old woman, usually the oldest in the family, gives the child a name, drawing her inspiration for it from whatever her eye happens to fall upon as she steps outdoors. A more common custom among the Jimdārs is to summon a *jotishī* to cast the child's horoscope and to find a name suitable to the conjunction of the planets. It is also the *jotishī's* function to purify

3 Compare Geoffrey Gorer, *Himalayan Village* (London: Michael Joseph, 1938), p. 287.

the house from the taint of birth. This can only be done after the mother has stopped bleeding, so the naming ceremony, known as Nauāran, usually occurs nine days after the birth.[4]

When the *jotishī* arrives on this occasion, a plate of dry, uncooked rice is placed before him, on top of which is a rupee or a few annas intended as an offering to him. Also placed before the *jotishī* is a brass vessel or *lota* filled with the *pānchgāv* or five products of the cow: milk, butter, curds, dung, and urine. Some sprouts of *dūb* grass are stuck in this vessel. The *pānchgāv* and *dūb* grass are purifying agents, used to cleanse the house from the contaminating effects of the recent birth. After reciting a few *mantras*, the *jotishī* places a little of the *pānchgāv* in the palm of each person present. These people then lick some of the *pānchgāv* and apply the rest to the top of their heads, while the *jotishī* sprinkles *pānchgāv* and *dūb* grass about the house. Now that it has been purified, people may visit the house freely.

Not all Jimdār groups use *pānchgāv* and *dūb* grass in this manner. The practices just described are followed by the Chāmling Jimdārs.

In giving a name the *jotishī* sometimes supplies only the first letter or syllable, leaving it to the older women of the household to fill out the name according to their preference. If the newborn baby is the first male child, the naming ceremony may be followed by a feast to which the Jimdārs of the community are invited. In towns like Darjeeling or Kalimpong non-Jimdār neighbors may also be invited.

NAMES

All Jimdārs have Rai for a family name, just as all Limbūs are called Subbā or Subhā, and all Yākhās are called Dewān. The personal name given in the Nauāran ceremony is used only sparingly by those who know it. A man is forbidden to mention his wife by name, and it would be a great dishonor if she were to utter his. If the question of giving his name should arise, the wife would ask someone nearby to state it. Generally, a person is reluctant to mention his own name or the names of others, and prefers to refer to people by means of epithets. A man may be referred to by his profession, or else a kinship term may be employed. These are extended to non-relatives; so that an older woman, for example, may be called grandmother, mother, or older sister, depending upon her age in relation to the speaker.

Terms according to order of birth — roughly equivalent to "First," "Second," etc. — are more frequently used by parents than personal names for their children. Beginning with Number One, boys are given such appellations in the following

4 Compare the account in W. Brook Northey and C. J. Morris, *The Ghurkas, their Manners, Customs, and Country* (London: John Lane, The Bodley Head, 1928), p. 193.

order: Jethā, Mailā, Sailā, Kailā, Āntarei, Jāntarei, Kānchā; for girls they are: Jethī, Mailī, Sailī, Kailī, Āntarī, Jāntarī, and Kānchī. In other words, a third boy will be called Sailā, a fourth girl Kailī. But the youngest child is always called Kanchā or Kanchī until replaced by a younger sibling.

By a different convention, twin boys are always named Rām and Lakshman, while twin girls are always named Gangā and Jamunā. No special names are given to the unfortunate twins of opposite sex.

FIRST FEEDING CEREMONY

Five months after the birth, in the case of a girl, and six months in the case of a boy, a First Feeding Ceremony known as Bhātkhuwāī takes place.[5] For this occasion a Damāī is asked to prepare some baby-clothes, the Damāī being a caste of untouchables, tailors by profession, who also provide music at weddings and other occasions. On the morning of this day, therefore, the Damāī comes to the house, bringing some clothes which he has made for the baby. He presents these clothes to the parents by offering them on a *nanglo*, or large bamboo tray about two feet in diameter. For the occasion he has also brought along his *sanāī*, or trumpet, upon which he now performs. After this solo concert, the child's parents offer the tailor some dried rice on a tray, on which there is also a small mustard-oil lamp. (Presentation of offerings on a *nanglo* with a mustard-oil lamp is a characteristic feature of Nepalese ceremonies.) On top of the dried rice offered to the tailor there is some money for his fees.

Later in the day relatives arrive with presents for the baby. The grandparents bring a pair of bangles for the child, even if it is a boy. Ideally, these should be of gold or silver and should be costly in any case.

The food prepared for the baby is offered in a special way. Various kinds of food are set forth, each placed in the folded leaves of the pipul tree, the corners of each leaf being pierced with bamboo slivers to make a convenient container. A fried egg, for example, is placed in one leaf, some meat in a second, rice in a third. These are all placed on the *nanglo*, together with the mustard-oil lamp, a leaf containing a silver rupee, and a brass *lota* which holds some flowers in clean water.

A few days before the ceremony the child's parents have consulted the *jotishī* to find out which member of the family — whether father, grandfather, or grandmother, etc. — should have the honor of feeding the child first. The *jotishī* has already figured this out through his astrological calculations; so the elected member of the family is ready to play his part.

5 Compare the brief account in Northey and Morris, *op. cit.*, pp. 240-241.

After the baby has been dressed in its new clothes, this person sprinkles some dry uncooked rice and flowers on top of the child's head and applies some rice with thick curds to the baby's forehead, accompanying this with his blessing. Then he places his present before the baby, after which he picks up the silver rupee from the tray, and, using it as a kind of spoon, dips it into each of the food dishes. He touches each kind of food in this way and then touches the baby's mouth with the silver coin.

The other relatives then file by, each performing the same set of actions. Their blessings express sentiments such as the following: "Have a long life!" "Be prosperous!" "May you have many children!" "May the evil eye never fall on you!" "May you be wise!" or "May you look after your mother and father when they grow old!"

The presents given to the child usually consist of money — one or two rupees each. A large number of people may be invited — generally only Jimdārs in the more rural areas. These guests come at all hours of the day until late at night. Curry, chutneys, and other foods are served, and in the evening music and singing take place.

Until this time the child has been suckled at the breast and received no solid food. This occasion marks the beginning of more solid nourishment, although it does not indicate the end of breast-feeding.

CHILD REARING

For the first four or five months the child is kept at home, largely through fear of the evil eye. Various kinds of amulets are employed to ward off evil spirits. Snail shells are tied to the cradle for this purpose. The knife which was used to cut the umbilical cord is inserted along the wall of the cradle, where it is believed to protect the child. A piece of paper covered with spells is rolled up and placed in a small cylinder called *tabīj*, tied to a string worn around the child's neck.

The child is not swaddled, as seems to be the case among the Tibetans, but is rather snugly packed into the cradle. The arms are not constricted, however, and the child has some freedom of movement in the cradle. If the mother goes out, she may carry the cradle on her back, using a tumpline over her forehead. In this case, the child continues to lie horizontally, not vertically as in the cradleboard of the American Indians. As evidence of how little the child's freedom of movement is restricted, one sometimes sees a baby, who is being carried in this way, climb up and throw its arm around the mother's neck. When the baby is a little older it may be carried astride the mother's back in a sitting-up position, supported by the mother's shawl.

There is a belief that two cradles should not touch or strike against one another. One of the two babies, it is thought, may have more powerful planetary influences than the other and may consequently endanger the weaker child.

Some of the cradles used in the home have rockers. Those in rural districts are said to be strung up on ropes, so that they may be swung back and forth by pulling on a string. Under either system the child may be rocked when he cries.

The child is also suckled when he cries. There is no regular feeding schedule, the breast being offered whenever the baby is hungry. The child is apt to continue suckling for about half a year after the First Feeding Ceremony; during this time, in fact, he will not get much solid food. Some children are suckled for four or five years, but the usual practice is for a child to be weaned at the advent of a younger sibling. Sometimes the mother puts a bitter tasting substance on her nipples to hasten the weaning process. This is made from a local shrub called *chīroto*.

Thumb-sucking is regarded with favor by parents, for in this way the child is enabled to get some self-satisfaction. Genital self-stimulation is frowned upon, however, and may be punished by slaps or even by whipping, for there seem to be very strict attitudes about sexual morality here. Beginning at around the age of three, children are taught not to show their private parts. At about the same age they learn to leave the house and to go to a nearby open drain to defecate. Apparently this toilet training is brought about gradually and is not associated with any severe punishment. It is believed that children quickly learn what is required of them. In general, children do not seem to be regarded as stubborn individualists whose will needs to be checked, but rather as being naturally compliant and obedient. When a young baby has done something wrong, the parents crook a finger and say *"Kurī kurī!"* (Shame!). Older children are cuffed or slapped for offenses. Parents try to inculcate attitudes of shame, modesty, and respect for elders. The last is fostered through the medium of the language and kinship system. There are different terms for older and younger brother, older and younger sister, etc. Different verb-forms are associated with these categories, respect-forms being required for elders, while an informal mode of address is used with one's juniors. As the child learns to speak, he also learns these kinship distinctions and the expected forms of behavior associated with them.

Shame seems to be an important social sanction. Another technique for eliciting obedience is the use of bogey men. Nepalese children are warned that if they are not good, Tibetans will carry them away. Tibetans are said to have made a practice of stealing children in the past and were consequently regarded much as gypsies have been regarded in the West. This is particularly true of the Tibetan beggars who come to the door, and whom the children learn to fear. When I asked

my informant if White men were ever used as bogey men, he said "No, just the opposite. Sometimes when a child is depressed, we say, 'Come, let us go and look for a white *sahib*, and maybe he will give us some *baksheesh!*' "

Since Nepalese families are large and the parents very busy, it is difficult to keep an eye on all the children. C. J. Morris says that it is unusual to see a Nepalese without scars on his head, the result of falling into the fire as a baby.[6] As it happens, my informant Kolsing Rai had facial scars resulting from this cause, but none of his twelve children had suffered such burns.

Children are expected to stay close to the house until they are about eight or nine. A lively fear of ghosts and evil spirits encourages the observance of this rule, particularly when it gets dark. Children do not leave the house after nightfall.

At night most children sleep doubled up, usually divided according to the sexes. The youngest child sleeps with the parents. It is a general custom to sleep with the head completely covered.

HAIRCUT CEREMONY

In the third year there is a ceremony for boys known as the *Pāchnū* or Haircut Ceremony. The Damāī is asked to prepare a new set of clothes — white trousers, white shirt, and a white cotton cap — which he brings to the house and presents to the parents on a *nanglo*.

Before the boy is dressed in these clothes, he is given a haircut by his maternal uncle. His hair must not be cut before this ceremonial occasion. If there is no mother's brother, some other maternal relative fills this role. The son of one of his mother's paternal uncles may be selected.

Various guests are invited, usually only Jimdārs, and they are given a feast. Rice used to be the main dish, but it is now very expensive, so *roti* and tea are offered instead. Some rice is needed for ceremonial purposes, however, for each of the visitors gives the boy a blessing, applying rice and curds to his forehead, as in the First Feeding Ceremony. Then a present is offered, usually a gift of one or two rupees. In former days the boy was given a pair of ear-ornaments known as *kundal*, which covered the lobes of his ears, but these are seldom seen nowadays.

After the haircut the boy is dressed in his new clothes. The shorn hair is carried away to some hidden place for disposal so that it will not be touched by anyone. There is no comparable ceremony for girls, whose hair is never cut.

The importance of the mother's brother and his role as barber seem to be the most interesting feature of this ceremony. It may be mentioned here that the

6 C. J. Morris, *Living With Lepchas; a Book about the Sikkim Himalayas* (London: Heinemann, 1939), p. 214. See also Gorer, *op. cit.*, p. 297. Dr Rodney Needham, who served with the Gurkha Rifles, tells me that such head-scars are very common among Gurkha soldiers.

nephew later on has occasion to repay this tonsorial service, for it is he who must shave his uncle's head at his funeral. Ties between maternal uncle and sister's son are supposed to be very close. If the boy's father dies, the uncle may ask to adopt the boy, since it is not considered likely that the family of his sister's husband will look properly after her son. There is a Nepalese proverb: "One must respect even a dog which comes from the village of a mother's brother."

SICKNESS AND CURE

By traditional concepts there seem to be four main ways of accounting for sickness: (1) displeasure of ancestors, (2) evil eye, (3) ghosts and evil spirits, (4) planetary influences.

It is believed that the ancestors of a family may have become annoyed if they do not receive adequate offerings from their descendants. The hostility of the ancestors, moreover, is thought to be commonly directed against the young children of the family, who may fall sick in consequence. One would think that it would not be difficult to keep the ancestors satisfied, for offerings need to be given them only once a year at the time of Baishak Purnimā. At this ceremony, known as Pittrā, a cock is sacrificed and prayers recited. Since Jimdārs do not also observe the traditional Hindu *srāddha* ceremonies, which are adhered to by Brāhman, Chettrī, and Kamī families, it would seem a simple enough matter to keep the ancestors contented. However, sickness is often attributed to this cause, particularly in the case of very young children. The danger to such children is conceived to be heightened at the time of unusual and ill-omened occurrences, such as a lunar eclipse.

At such times a steel bangle may be given to a sickly child, to be worn on his right wrist, contrary to the usual custom of having a pair. This steel bangle, I was told, is a device for avoiding the ancestors' displeasure, for it associates the child with the blacksmith caste, which somehow gives the child protection from the family dead. A similar device is a leather band, also placed around a child's wrist on the occasion of a lunar eclipse. There is a legend associated with this practice, concerning the god Indra. Indra borrowed a sum of money from a Chamār, an untouchable leather-worker, but did not repay him when the loan was due. The angry Chamār chased after the god, intending to swallow him. This is the explanation of what occurs at a lunar eclipse. People who witness such an eclipse therefore cry out "*Chorde* Chamār, *chorde* Chamār!" In other words: "Chamār, leave the god alone! Don't swallow him!" At the same time drums are beaten as loudly as possible, family kitchen utensils are rattled and banged, and dogs are pinched so that they will squeal or bark. It has already been mentioned that pregnant women should not see such an ill-omened sight; it is also dangerous for children, who are

easily exposed to malevolent influences from ancestors and other spirits during their early years. As a protective measure, therefore, a leather band is placed around the child's wrist, where it remains for two or three years. Just as the steel bangle associates the Jimdār child with the blacksmith caste, so the leather band allies him with the untouchable Chamārs. In both cases the child is given protection through alliance with another caste-group. As an additional talisman at the time of an eclipse, an old copper pice is pierced, threaded, and hung from a string worn around the child's neck.[7]

The evil eye is another source of danger to children. Men are never suspected of the evil eye in this region. It is only women who are said to have it, but there are not believed to be many such cases. A woman of this kind is known as a *boksī*, a witch who has made a kind of pact with evil spirits, promising them a human life in exchange for wealth and personal happiness. Charms are worn to forestall a *boksī's* influence.[8]

Evil spirits and ghosts may also make people fall ill, particularly children. One such evil spirit is Burenī, an old woman who is said to spend her summers in the mountains and winters in the plains. She is sometimes heard walking across the roofs at night. If, in the course of her travels, her shadow falls across a child, the child will get sick. If a child is very restless or has convulsions, it will be attributed to this cause, and the treatment will consist of a *pūjā* offered to Burenī after sunset. A stone representing the old woman is set up in an open place outside the house, with a white cord twisted around it. Vermilion powder is applied to the stone and *pān supārī* offered. Then a small black chicken or a pair of pigeons may be sacrificed to Burenī, after which the child is expected to improve.

Egg-divination is also resorted to at this time. The shaman who officiates at a *pūjā* breaks an egg, examines the yolk, and predicts the child's course of recovery according to its appearance.[9]

7 Fear of the ancestors is sometimes expressed in other customs. Kolsing Rai, for example, told me that his family never eats goat meat. This is a family tradition; if it were ever broken, his ancestors would be angry. Therefore, at the time of the Dūrgā Pūjā, when goats are customarily sacrificed, he kills a sheep instead, to avoid their displeasure.

8 It is believed that a *boksī* goes out at night, either alone or with other such women, to a lonely place, taking along a small lamp, some *pān supārī* (a betel nut preparation) and *sindur* (red powder), to be used in the offering of a *pūjā*, or ritual of worship, to the evil spirits. This is where the pact with the spirits is made.

9 Egg-divination is sometimes done on a mass scale at the time of epidemics, when a Sānsārī *pūjā*, or "World" *pūjā*, is offered to Sānsārī Mātā, World Mother. The local medicine men then collect money from every household in order to give a *pūjā* for the whole village. A goat and some pigeons may be sacrificed. Each household contributes some dry rice and an egg. The medicine men make use of the latter for divination purposes in each home, foretelling how the members of the family will withstand the epidemic and what they must do to keep well. The eggs are then collected, pooled together, and an omelet is made. The ceremonies last all day. A Sānsārī *pūjā* is performed once a year in some villages as a preventive measure, as well as being a resort in emergencies.

Ghosts may also cause sickness. These are usually female ghosts known as *churel*, who single out unmarried boys in their teens for their attentions, visiting them at night to make love to them. If a *churel* does not leave the boy alone, he will become progressively weaker and die in order to join her. In 1952 there was a case of this kind at the town of Ghum near Darjeeling. There was a widespread interest in the affair, for the boy had described his visits from the *churel*. Medicine men were called in, however, and helped drive her away, so the boy recovered.

The medicine men who perform these functions, and who do egg-divination, etc., are known as *bijuwā* among the Jimdārs and Yākhās. In most respects they resemble the *jhānkrī* of other Nepalese groups, such as the Chettrī, Newār, Gurung, Magar, Sunwār, Tamang, Kamī, and Damāī. The analogous Limbū specialist is called *fedāngmā*. The *bijuwā* is differentiated from the other types of medicine men in that he must memorize and recite a body of sacred oral literature known as *Mudum*, consisting of prayers, songs, cosmological traditions, and accounts relating to early history.

If sickness is believed to be due to planetary influences rather than to ancestors, *boksī*, ghosts, or evil spirits, a different specialist is called in. This is the *jotishī*, the Brāhman astrologer. The latter seldom attributes a sickness to evil spirits or the evil eye. He is much more likely to say that the *grahā*, or planetary influences, are responsible. But his treatment, like that of the *bijuwā*, involves the offering of a *pūjā* — to the planets, in this case. Moreover, sacrifices are also required, and these may be very expensive. The *jotishī* consults some tabulated rules which indicate how many lambs must be sacrificed to Mars, or how much cotton cloth and gold thread must be presented to Venus. The cost of such items may amount to forty rupees or more. It is cheaper, therefore, to consult a *bijuwā* or *jhānkrī* in the event of sickness, and most people do so first, only turning to the *jotishī* if the others have failed. In the rural villages, moreover, Brāhmans are scarce, while *bijuwā* or *jhānkrī* are usually available. The Brāhmans are located mainly in towns and probably represent a later type of medico-religious specialist.

CHILDREN'S PLAY

The eastern Nepalese children in Darjeeling are very active and are often seen playing with great energy and hilarity in groups ranging in number from two or three to seven or eight, usually consisting of children of the same age. Much of their play seems to consist of organized games. In these respects they apparently differ from the Lepcha children described by Gorer.[10] Except in the case of family groups, children are generally segregated according to sex; for in keeping with the strict views of sexual morality, boys and girls are warned not to play together,

10 Gorer, *op. cit.*, pp. 308-309.

beginning at the age of five or six. There are different games for boys and for girls. Even when both sexes play the same game, such as a form of hide-and-seek, the boys and girls play separately, each group by itself.

Girls play with dolls, particularly female dolls. In this respect, as in many others, their play seems much like that of Western children. They feed the doll, talk to it, and carry it on their backs in a cradle. Playing house is also common. Girls collect mud and pretend that it is rice. The older ones act as mothers and pretend to feed the younger children. Imitation of adult *pūjās* and religious festivals is very popular among the children. After the Sarasvatī *pūjā*, for example, children made images of Sarasvatī out of mud and arranged moss and flowers around them. Then the goddess was carried along in procession to the accompaniment of songs.

In Darjeeling some of the games which are popular seem to be of Western type, introduced, perhaps, through schools in the area. For example, there is a game like hop-scotch, in which the girl must hop from one square to another. Girls also play a game with five pebbles, like jackstones. As one pebble is thrown up, the girl must pick up other pebbles lying in front of her. First she must pick up one pebble three times in a row, and then two, three, and four pebbles — each three times. The one who does this first wins.

Boys play with marbles, knives, and slings. The Nepalese knife, or *kukrī*, is an important male possession. The more conservative Nepalese will never part with it and always wears it tucked into the band wrapped around his waist. Boys are generally given a *kukrī* at around five or six years of age.

There is a game which the Nepalese have borrowed from the Tibetans, known as *thepi* or *chungī*. A lightweight feathered object like a shuttlecock is repeatedly kicked into the air with the foot, the object being to keep it from falling to the ground. Among the Tibetans this is a girls' game, but among the Nepalese it is played only by the boys.

While boys play close to home until the age of eight or nine, they may go further afield after that. Boys of twelve and thirteen often wander about in the woods hunting birds with slings.

CHILDREN'S WORK

Children begin to share adult activities at an early age. Children of three, four, or five may often be seen carrying little bundles on their backs. At five or six they are given the task of looking after younger brothers and sisters, whom they carry about on their backs. At six or seven they help their mothers bring loads from the market place and may also join them in carrying stones. When building work is in progress in Darjeeling, contractors pay men, women, and children about three

annas per stone (about three cents), or four annas if the stones are hauled over long distances. These may weigh eight to ten pounds. A strong woman can carry a weight of about 140 pounds and can earn about two or three rupees a day in this manner (from 40 to 60 cents). Sometimes the whole family joins in; mother, father, and children walking along together, each bending forward under the weight of stones, with a tumpline stretched across the forehead. Generally, however, this work is done by the mothers and daughters, who walk barefoot, for this is said to give the feet a better purchase on the ground. A small child may carry a single stone, while an adult carries a basket containing several. The children do not seem to be made uphappy by doing this work; if anything, they look rather proud of being able to carry their share of the family load. This joint labor may increase the sense of family solidarity.

In the valley districts boys and girls work in the tea plantations, starting at the age of six or seven. They are generally given the job of pulling moss from tea bushes. Older children from twelve to fourteen work at tea-picking. Some boys herd cattle and goats. Others are sent to cut grass with their *kukrīs* as fodder for livestock. Boys and girls carry firewood and water for their parents. Girls also learn to cook at an early age.

A girl of ten, therefore, is practically an adult. She wears the same kind of clothes as her older sister and mother and shares their responsibilities. The advent of first menstruation is guarded with secrecy. The girl is told to stay at home on such occasions, for she may cause flowers and crops to wither if she goes out in the fields. She must also stay away from temples or places of worship. For the rest, her life continues much as before. There are no puberty ceremonies for either boys or girls. The Jimdārs do not have a sacred thread ceremony for boys.

CLOTHES AND ORNAMENTS

Boys and men wear a long shirt and rather tight long trousers. Very short trousers are also worn. Wrapped about the waist there may be a band of cloth four or five yards long, in which the *kukrī* is inserted. A small cap is worn on the head, usually white, but sometimes black. The *tupī*, a kind of pigtail or topknot, is worn inside the cap. It is considered a sign of degradation if the *tupī* is cut. Some Nepalese in Darjeeling, particularly students and white-collar workers, wear Western dress and have no *tupī*. Small boys may wear earrings or bangles until six or seven years of age. Nepalese girls wear a blouse, a wrap-around skirt six yards wide, and another yard of cloth which is used to further cover the breasts, over the blouse. A woman's breasts and hair must not be seen. A kerchief covers the hair. A band five yards long is wrapped around the waist. A woman's feet are generally bare, men being more apt to wear shoes than women.

Nepalese women customarily wear a lot of jewelry — bangles, anklets, nose-ornaments, earrings, etc. A girl receives a pair of bangles at her First Feeding Ceremony, and after that is never without at least one or two pairs. Bangles for the ankles are also common. These must be made of silver and are sometimes quite heavy. Nose-ornaments are of various kinds. One type is a plaque of gold affixed to the left nostril. Another dangles over the upper lip, suspended from the nasal septum. Perforation of the nose takes place at the age of five or six, and is usually done in winter, when cold weather helps to check bleeding. After the bleeding has stopped, a little stick is inserted into the hole made in the nostril or in the nasal septum. This keeps the aperture open, ready for the time when ornaments are given to the girl, which may be at ten or eleven years of age.

Tattooing is popular among both sexes. Its purpose is aesthetic rather than magical; it is usually done on the arms by both boys and girls when they are in their teens.

DISCUSSION

In my previous article on the Jimdārs I pointed out that they do not seem to be particularly well prepared for individual courtship, since their childhood training emphasizes sexual segregation and considerable restraint. Boys and girls are not encouraged to talk together, and are expected to be shy.[11] In Ruth Benedict's terms, their life cycle, in this respect, is marked by discontinuity. That is to say, the individual, at one stage in his development, must unlearn something previously instilled in him.[12] This is in contrast with a relatively greater degree of continuity in modern American culture in this respect, where coeducation is found in all age-groups from kindergarten to college, at least for large segments of the population. "Dating" may begin early in high-school, or even before, thus establishing an early social-psychological preparation for later courtship. One cannot, however, say that American marriages are markedly more successful than Jimdār marriages on that account, for other factors are at work as well.

In another important area there is much greater continuity to be found in Jimdār culture than in the United States. This concerns the adoption of adult roles in work, which begins well before the age of ten among eastern Nepalese as it does among many rural or "primitive" peoples. The sharp contrast evident in our society between the responsible adult who works and the non-responsible child who plays does not appear in the same form among the Jimdārs. A Jimdār child

11 Barnouw, *op. cit.*, p. 17.

12 Ruth Benedict, *Continuities and Discontinuities in Cultural Conditioning* (Psychiatry, vol. 1, pp. 161-167, 1938; recently reprinted in *Childhood in Contemporary Cultures*, edited by Margaret Mead and Martha Wolfenstein, pp. 21-30, Chicago: University of Chicago Press, 1955).

of seven or eight works *with* the family at the same kinds of tasks that the parents perform, and the little boy or girl wears the same kinds of clothing that the adults wear. Their work is not mock-work or mere imitation, but represents a real contribution to the family welfare. This does not at all mean that boys and girls do not also play games and enjoy themselves as children. They do, but the responsibilities of adulthood begin much earlier than with ourselves. In this sphere, at least, there is nothing for the individual to unlearn.

Patterns of individual courtship, if they are to be perpetuated, must require some preparation in childhood. Thus, there must be more conditioning along such lines than appears in the data presented above. One would guess, for example, that concepts of romantic love would be emphasized more among the Jimdārs than they are among their neighbors, whose marriages are parent-arranged. And other differences should also be expected. Perhaps further work in this area will show whether a society having individual courtship, like that of the Jimdārs, must place more stress in childhood upon the quality of individual initiative than is done in a society where marriages are arranged, and where one might expect passive conformity to be fostered as a virtue. Hypotheses of this sort can be examined in a region like that of eastern Nepal, where there are groups showing many of the same culture patterns, but differing with respect to the ways in which marriages are contracted.

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THE CULTURAL DEVELOPMENT OF THE NORTHWEST COAST

MARIAN W. SMITH

EARLY RECONSTRUCTIONS of North Pacific development rested on three conclusions already defined by the time of Harlan I. Smith's archaeological surveys published in 1899.[1] These three initial assumptions concerned: (a) relationships between the Northwest Coast and the American Arctic and/or Asia; (b) the significance of an old climax of culture on the lower Fraser River; and (c) the westward movement of cultural traits from the interior to the coast. When Drucker viewed the Northwest Coast in 1943 from the materials of his survey of northern sites, he accepted each of these,[2] and one or more of them have been variously involved in all reconstructions to date.

More recent work has led to two new formulations both of which are primarily relevant to the third initial assumption, i.e. to the interchange of coastal and interior traits. These are: (1) the recognition of a coastal stone-chipping tradition of some age, and (2) the reconstruction of a prehistoric cultural province in the foothill regions of the Cascades and the Coast Range. The first of these rests on new archaeological data. It was presaged in the excavation of Wakemap mound, strengthened by the Suquamish finds and confirmed by the stratigraphy of Cattle Point.[3] The total archaeological picture in which this coastal province finds its place is reviewed briefly below. Some of its implications are also examined but complete exploitation of this new orientation must await further excavation.

Unlike the preceding, the second recent formulation relies largely on ethnographic data. Certain similarities have been noted[4] within the western longitudinal subarea of the Plateau, Inland Puget Sound, and the middle Fraser.[5] It is here suggested that these areas formed the nucleus of a single prehistoric foothill province and, further, that acceptance of such a reconstruction serves to explain both the position of the Bella Coola and the distribution of the massive stone sculpture of the Pacific Northwest.

A reconstruction will vary somewhat as the view shifts from one focal point to another and in this paper the Northwest Coast is seen consistently from the

1 H. I. Smith, 1899a; 1899b; 1899c.

2 Drucker, 1943, pp. 23, 126.

3 Strong, Schenck and Steward, 1930; Smith, 1950a; and King, 1950, respectively.

4 Smith, 1952.

5 Ray, 1939; Smith, 1941; and Smith, 1947, respectively. Harlan I. Smith also suggested a somewhat similar relationship on archaeological grounds; see fn. 57.

area of the Columbia and Fraser River drainages. Charts I-III are designed to illustrate several stages of reconstruction but like all such drawings are meant to be more tentative than they seem. It should be stressed that the main aim of this presentation is to furnish the background for future work. It leans heavily on the references to Northwest Coast culture history which have appeared for many years in anthropological literature and on two former papers of mine which were similarly dependent on the analysis of existing data and comment. The time has long passed when American Indian material may be treated in a scholarly vacuum, or by reference to a few widely read sources. The following sections, therefore, constitute a summary of data; and the final sections also aim to illustrate some of the values of the comparative method to questions of historical perspective.

CHART I: ARCHAEOLOGY AND THE INITIAL ASSUMPTIONS

Archaeological data for the Northwest Coast are meager and unsatisfactory. Although a start has been made toward developing a geochronology for stratified cave sites on the middle Columbia River,[6] a full report of any of the rich Fraser strata has yet to appear, and data now available are insufficient for the firm establishment of horizons in terms either of absolute or relative chronology. Despite this generally gloomy picture, it remains true that considerable attention has been directed to the archaeology of the Columbia-Fraser region. The four sections of this part of the paper describe my 1950 survey of this material,[7] and discuss it in relation to each of the three initial conclusions concerning Northwest Coast history that are cited above.

The Columbia-Fraser Region

If much of the value of the early references is not immediately apparent to the archaeologist, this is due not so much to any suggestion that the workers were lacking in integrity or descriptive ability as to their natural ignorance of modern methods and techniques. Trait assemblages reported over a fifty-year period might thus be insufficient for detailed comparisons along modern lines, but some comparisons could be drawn.

The data revealed that two rather generalized features served to characterize Columbia-Fraser sites. These were the presence or absence of incising and/or carv-

6 Swanson, n.d. I wish here likewise to express my deep appreciation of Earl Swanson's presence in London while this paper was being written. Not only did he draw the final copies of the charts and compile the map, but he also was a constantly interested discussant — the value of his coöperation can never be over estimated.

7 Smith, 1950a. Although published in 1950, this study was completed in the summer of 1948.

ing of bone and/or stone, and the relative quantities of bone and stone artifacts recovered.

The first of these features could be credited immediately with some significance because of the importance generally attributed to the prehistoric massive stone sculpture of the area and to the elaboration of wood sculpture among historic Northwest Coast cultures.

The second had a more tenuous validity. Although stone chipping had early been understood by Harlan I. Smith as an interior trait reaching the coast via the Fraser valley, this generalization had been thrown into some doubt by the

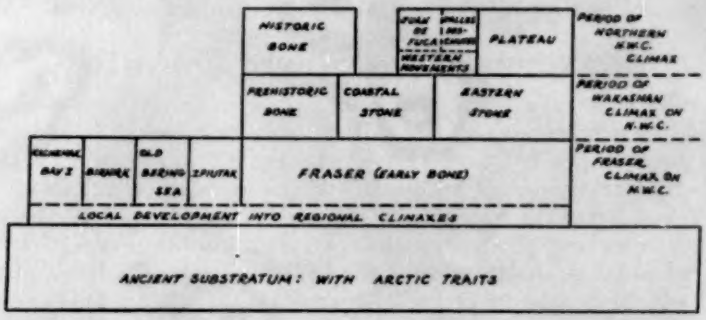

CHART I. Columbia-Fraser sequences: mainly from archaeological data (after Smith, 1950a; periods of climax from Kroeber, 1939; Arctic horizons from de Laguna, 1947).

discovery of coastal sites rich in stone chipping. In the same way, bone, which so predominated over stone in many of the historic groups of the area, was also found in quantity at the lower levels of stratified Fraser sites. The cultural significance of relative quantities of stone and bone was thus far from clear. In addition, the problem of the extent to which conditions for survival affected the numbers of bone pieces in any given assemblage could not be overlooked. Yet moisture alone does not necessarily make for the destruction of perishable materials,[8] and some strata which yield few bone artifacts show fairly well-preserved fish bones, so that differing conditions are not sufficient to explain differences in the relative quantities of bone to stone reported. Wakemap stratigraphy, when reëxamined from this point of view, yielded evidence of an early period (below 2.7 m) when

8 Borden (1951) reports that "The deposit at Musqueam below the water table, encountered at a depth of 6 feet, is completely waterlogged, and excellently preserved perishable material was recovered from this."

stone predominated; a level between 2.4 m and 2.7 m marked by "a definite stimulus"[9] to work in bone and antler; and above the 1.65 m level a return to relatively greater proportions of stone.[10] Since bone, and chipped and ground stone, occurred at all levels, one obvious distinction between levels lay in these relative proportions. Beardsley uses a like criterion for characterizing central Californian horizons.[11]

With some reservations, therefore, these two criteria were accepted for the preliminary establishment of descriptive categories. All of the sites, of course, were located geographically; and for some of them the field worker furnished his estimate of the age of the materials. The time depth was then further extended by reviewing the ethnographic literature for clues as to the relative use of bone and stone in the general regions for which archaeological data were given. In this area where Western contacts cannot be dated before the nineteenth century, it was thought feasible to regard the ethnographic material as equivalent to one archaeological horizon. Artifact assemblages were thus finally grouped according to four criteria: presence or absence of incising and/or carving on bone and/or stone; relative numbers of bone to stone implements; geographical position; and estimated age, if available. The cultural streams distinguished in these terms were not given a terminology borrowed from archaeological taxonomy, for it was felt that this would suggest an archaeological validity the material did not warrant. Instead, the last three criteria listed were variously combined in phrases purely descriptive of the cultural streams themselves.

Three major, contrasting cultures were thus isolated: *Early Bone* (with carving, situated on the lower Fraser River); *Eastern Stone;* and *Coastal Stone* (rich in chipped stone, and without carving). In addition, two coastal phases of Eastern Stone were distinguished: *Juan de Fuca* and *Deschutes-Willamette* (both with carving); and two aspects of a *Late Bone* culture: Prehistoric (with little chipped stone and no carving) and Historic (also with little chipping and no carving — except of course in wood). Coastal Stone and Late Bone had a wide distribution, occurring over most of the north-south extent of the coastal plain from the Fraser to south of the Columbia. Eastern Stone was similarly widely distributed east of the mountains. But the other cultures were limited in area, suggesting that they

9 Strong, Schenck, and Steward, 1930, p. 68.

10 Smith, 1950a, pp. 25, 32, 33. These figures represent a reworking of the data contained in the tables for Wakemap.

11 Beardsley (1948, p. 6): ". . . an attempt may be made to characterize the distinctive flavor of each [horizon] in concrete terms, one can point to the predominating interest of the Early Horizon in stone materials, of the Middle Horizon in bone, and of the Late Horizon in shell." Shell appears in Columbia-Fraser materials only in the late period (Smith, 1950a, p. 35; Table 3), but this correspondence is somewhat nullified by King's note that shell artifacts are difficult to identify in strata with much midden shell (1950, p. 59).

were relatively recent. Trait lists for these cultures are not given here both because they appear in the 1950 report and because they are subject to considerable revision as the data increase.

There were glaring gaps in these distributions, but such gaps are not unusual in archaeological materials and the identification of seven cultural streams, with some data on location and age, furnished a systematic basis for an examination of Columbia-Fraser sequences.

The Ancient Substratum

It has been usual to interpret many of the Arctic and/or Asiatic connections of the Northwest Coast as due to survival from an old cultural stratum. The description of the substratum given by Kroeber in 1923[12] was referred to by Boas as "untenable" because of his cautions regarding the absolute validity of the age-area concept.[13] In part, however, his objection seems to have rested on a particular interpretation of the word "substratum": he refers to the body of a clay vessel as "the substratum for decoration."[14] His objection is thus largely neutralized, for Kroeber probably did not mean that recent Northwest Coast culture formed only an overlay on a firm and completely perpetuated base, or even that it was a design through which such a base could be glimpsed. Certainly the use of "substratum" on Chart I is not intended to imply this. *A substratum is here meant to signify an assumed, or partially reconstructed, cultural stratum from which certain features survive.* Survival of unaltered traits probably occurs less frequently than of traits which have undergone change of one type or another; and survival may either be relatively shortlived or extend into successive strata. Furthermore, survival which is demonstrated for one area cannot be assumed to have taken place in other regions which once shared the culture of the substratum. This is obvious, since survival itself is dependent on manifold influences.

Kroeber refers to the stratum which he postulated at the base of Northwest Coast culture as "primitive." By this he meant not only that the stratum was older but that it was relatively undifferentiated.[15] He also assumes that it covered a wider area than highly developed Northwest Coast culture. Both of these assumptions are implicit in the substratum of Chart I. The next stratum of culture is, indeed, regarded as a series of particular differentiations. These followed somewhat divergent directions and were due to different circumstances. But each is thought of as reaching a climax of cultural complexity and differentiation and as covering a region considerably less in extent than that of the substratum. Nor does the sum of the regions occupied by the cultures of climax equal that of the substratum.

12 Kroeber, 1923, p. 8.
13 Boas, 1927, p. 6.
14 *Idem*, p. 19.
15 Kroeber, 1923, p. 7.

The substratum is actually thought of as fairly extensive. Boas planned the Jesup North Pacific Expedition in 1897 specifically to test the Asiatic derivation of American culture traits. Many studies of Northwest Coast culture since then have given attention to the circum-Pacific distribution of traits and Kroeber, after pointing out the unusual degree to which the Northwest Coast has placed its own stamp on its cultural materials, adds that "perhaps as much of the reworked material derives from Asiatic as from distant American centers."[16] There has also, however, been a tendency to limit the Asiatic areas discussed in relation to the Northwest Coast to the Arctic portions of Asia, and as early as 1910 Boas considered the development of Northwest Coast culture in connection with a circumpolar distribution of traits. He then tended to explain the fundamental similarity of Northwest Coast cultures by an "old unity" of culture over a large continuous area.[17] This common basis is parallel in many ways to Kroeber's stratum. It is noteworthy, however, that even as late as 1933, Boas referred to "circumpolar culture traits"[18] and not to a circumpolar area. The substratum of Chart I surely refers to this circumpolar distribution but it is difficult for me to say at this late date that I did not also have a vaguely defined circumpolar area in mind. There has been considerable confusion in the literature about this point. It is quite clear to me now at any rate that a substratum refers primarily to a trait assemblage and only secondarily to the area in which that trait assemblage occurs.

The same relative stress is brought out by the fact that the substratum has been thought of as not only Arctic but also North Pacific, to use de Laguna's distinction.[19] As such it includes sub-Arctic traits. When this assemblage is brought far enough south to include generally southern Northwest Coast complexes, and similarly extended on the Asiatic side of the Pacific, there is a present tendency to think of this further dimension as part of a total substratum characteristic of the North Pacific rim. Certain correspondences between the southern prongs of the North Pacific rim, such as rod or slat armor, have often been thought of as relatively late and hence separate from the substratum. Arctic as the substratum may be in many ways, it is significant that its southern extension also means that certain typically Arctic traits, such as tailored clothing, must be omitted from it.

The Fraser Climax

Historical reconstructions are generally based on both archaeological and ethnological data and this was true in the case of the substratum. The trait lists drawn up for strata relevant to the Columbia-Fraser by de Laguna[20] and

16 Kroeber, 1939, p. 28.
17 Boas, 1910, p. 338.
18 Boas, 1933, p. 350.
19 de Laguna, 1947, pp. 268-269.
20 *Idem*, pp. 270-282.

Drucker[21] are, on the contrary, largely limited to archaeological materials for which established sequential details are, or may some time be, available. King's attempts to correlate Cattle Point strata with these lists[22] may eventually be suggestive, but they cannot serve in the place of a fully worked out sequence and he offers little evidence on which his finds may be dated. The only date available when the survey was made was the highly tentative one of 1500 to 2000 years ago for the Fraser climax. The conditions on which this figure was estimated have since been confirmed by Borden[23] but at the time the only confirmation lay in the postulated dates of de Laguna's Arctic horizons.[24] The survey, being restricted to archaeological materials, had to lean heavily on this relatively weak prop. As it turns out, the date now seems to have considerable relevance and is referred to again below in connection with Chart III. In this stage of the work, the more conservative figure was taken and the substratum was given an upper limit of 500 AD.

Charts often depict cultural growth in the form of a box or pyramid, with a broad base of undifferentiated traits developing in the same locality or culminating in an apex or climax. Such a picture is certainly too simplified. The Fraser climax represented here covered a limited geographical region and, if the cultures shown as later than it in time did indeed derive from it, its area was much less extensive than that occupied by its derivatives. This fact could probably be much better represented diagrammatically by a figure more like an hour glass than a pyramid or box.

The question for which the least satisfactory data are available lies in just this relationship between the Fraser climax and the three cultures represented on Chart I as later than it in time. Among them, these three cover all of the Columbia-Fraser region. It seems unlikely that the Fraser climax alone accounts for all of their characteristics as the chart might suggest — and the trait lists do not indeed bear out any such supposition. Various alternatives, more attractive in theory, are discussed in the body of the 1950 report but, since the Fraser climax was the only horizon for which any date was given, and its significance had always been generally accepted, it was thought wisest to retain its key position in Columbia-Fraser cultural development. The chart is probably correct in the sense that the rich culture of the lower Fraser influenced the groups with which it came in contact. Actually, such an influence is implicit in the use of the term climax.

Interior-Coastal Traits

The westward movement of interior traits is often understood as a movement of hunters and gatherers of undifferentiated culture to the coast where they subse-

21 Drucker, 1943, pp. 123-127.
22 King, 1950, pp. 82-87.
23 Borden, 1950, p. 18.
24 de Laguna, 1947, p. 12.

quently developed the maritime culture typical of the northern Northwest Coast. The existence of up-river groups on almost all streams was taken as confirmation of this westward drift and eventual coastal adaptation. The Coast Salish of such inland waters as Puget Sound were thus thought of as representing an intermediate stage in the general process.

In the deep sites of the lower Fraser, Smith found undisputed proof of a correspondence between interior and coastal traits which was taken as archaeological confirmation of this. Drucker, however, using the same data, was unable to decide whether the "interior elements form an old substratum or late overlay" of coastal traits.[25] This point is well taken. Some of the trait assemblages described by Smith differ in the presence or absence of carving and the proportion of stone over bone and, by the initial criteria of the Columbia-Fraser survey, these sites had to be differently allocated. The term "Marpole" was thus retained for the highly developed culture of the Fraser climax and "Eburne" for those trait assemblages which had no carving and larger quantities of stone, despite the fact that both were reported from a single mound. Eburne was given a respectable age by Smith and this, plus the existence of the early strata at Wakemap and Cattle Point and the numerous chipped-stone finds at Suquamish,[26] led to an assumption of a fairly long time span for Coastal Stone. In the same mound (Marpole-Eburne), Borden has recently reported an undisturbed stratum without the ground-stone points so typical of usual Marpole remains,[27] so that we may hope eventually to have stratigraphic answers to some of these questions. In the meantime, acceptance of the identity of Coastal Stone and recognition of its relative antiquity go some way toward furnishing an answer to Drucker's moot point: the chipped-stone artifacts of early Coastal Stone may well have formed part of a substratum continuous with an interior chipping complex; coastal sites in the neighborhood of the lower Fraser may then have received a late overlay of interior elements which arrived after the differentiation of the Fraser complex and may be identified in the Juan de Fuca culture cited above. Both of Drucker's possibilities would thus be allowed for.[28]

King interprets his Cattle Point strata in terms of the simpler hypothesis, seeing a gradual elaboration of maritime adaptations. By calling his earliest phase "Island," he places it some way along in development. During all of its occupation Cattle Point was apparently an island site and any of its inhabitants had to reach it by some sort of fairly highly-developed sea craft. Fish as well as mammalian

25 Drucker, 1943, p. 126.

26 Smith, 1950a, pp. 5-15.

27 Borden, 1950, p. 18.

28 Harlan I. Smith (1900, p. 433) actually envisaged somewhat the same process: ". . . the peoples of the coast and those of the interior developed on distinct lines, and . . . points of resemblance are due to later contact." Caldwell also quotes this passage (1954, p. 24) and feels that it agrees with his recent data from the Okanagan and Similkameen valleys.

remains occur throughout the strata, and this is certainly not an "interior" culture. But what distinguishes "island" from "maritime," the term King uses for his most developed phase?

King speaks continually of Island "economic life" as "better adapted to land than sea resources" and of Maritime with "a full adaptation to the exploitation of the sea."[29] One of the criteria often used for the "maritime" development of a culture is the presence of whaling. Whale remains did not occur in the Island phase, but only four specimens are reported from the Maritime; harpoon points do not occur in the Island phase but of 233 bone pieces assigned to the Maritime only seven are harpoon points. "Identifiable harpoon points are rather rare at the Cattle Point site"[30] and evidence of real whaling is lacking at any level. Historic cultures in the area used harpoons for seal as well as for whale, and harbor-seal remains occur in all strata of Cattle Point, the increase in Maritime being somewhat less than the general wealth of the stratum would have led one to predict.[31] Black-tailed deer constitute the most common mammalian remains in all strata: they form forty-seven percent of mammal remains in the Island phase, but they also form thirty-nine percent of Maritime remains. Moose and black bear occur in both Island and Maritime. Mountain goat and sheep occur in Maritime but not in Island. If the greater elaboration of the Maritime phase suggests that it is more fully adapted to a maritime existence, it also seems better equipped to exploit its land resources. The level seems, as King himself says in another connection, "to create a picture of a culture very similar to modern historic groups"[32] in its broad outlines. These were peculiarly adapted to an environment of inland waters. Their habitat was that of streams and salt-water beaches, of islands with hunting and marine life equally accessible. Both the Island and Maritime phases seem to fit such an environment. Depending on the definition of "maritime," they are both maritime, or neither is maritime. One is much richer than the other, but both seem to depend on varied resources stemming from land as well as sea.

The unique quality of Northwest Coast culture has been referred to several times above and this facility for reworking cultural elements in its own terms seems also to have extended to the creation of local variation. This picture of an over-all similarity and a local autonomy is certainly typical of the ethnographic material, and is supported by the relative uniqueness of archaeological assemblages from one Columbia-Fraser site to the next.[33] The hypothesis concerning the westward movement of interior traits may therefore have to receive an elaboration

29 King, 1950, p. 12.
30 *Idem*, p. 54.
31 *Idem*, Table 12, p. 90.
32 *Idem*, p. 88.
33 Murdock's recent reference to Northwest Coast cultural process (1955, pp. 364-365) cites only the first of these (over-all similarity). The second (local autonomy) is equally significant.

which allows (a) for the maintenance on the coast of various stages of maritime adaptation for relatively long periods of time[34] and (b) for the secondary development of local traits. However the question of interior influences is finally settled, the Coastal Stone tradition will probably be seen as having been almost extinguished by the historic period.

A reconstruction in terms of simple hunters and gatherers reaching the coast and there developing a highly specialized maritime culture may be correct in its broadest terms. But it is too much to expect that such groups as the Puget Sound Salish of the ethnographic horizon fully represent any transition which took place in the northern Northwest Coast, or that a simple sequence of interior-to-coastal traits will ever be established.

CHART II: ETHNOGRAPHY

Chart II is based on an analysis of culture area data in which an attempt was also made to achieve some degree of cultural depth.[35] The reconstruction arrived at lends itself to treatment similar to that given to archaeological sequences.[36]

Culture area designations for the Northwest Coast have always recognized the importance of the North American Salmon Area, and migrants to the New World are not ever thought of as having a fully differentiated Arctic culture. It seems natural, therefore, to regard both of these specializations as springing from an undifferentiated base. The base is identifiable with the ancient substratum earlier postulated but, as indicated in the discussion of that stratum given above, it is now usual to think of it in terms of correspondences around the North Pacific rim.

Time must also be allowed for the development within the Salmon Area of the highly specialized culture of the northern Northwest Coast. This has always been distinguished in the literature from more southern regions on the basis of various social and ceremonial traits. Although its full development, as witnessed in the historic period, is probably recent, certain elements, such as clans, have generally been viewed from the perspective of Old World matrilineal institutions. Whether or not a common origin for New World matrilineal features is accepted, their presence among the groups of the northern Northwest Coast has not been thought of as recent, or due to a late diffusion of traits. Garfield believes them to be "due to local elaboration, integration and reworking of cultural material"[37] and her conclusions confirm that the cultural materials must be relatively remote in origin. One cannot help feeling that they rest at least partially on particular coastal-

34 As Borden (1950, p. 25) says of his Whalen II horizon: "They *persisted* in using chipped projectile points and lamellar knife blades" (italics mine).

35 Smith, 1952.

36 *Idem*, p. 90.

37 Garfield, 1953, p. 61. See also Garfield, 1951.

interior relations set up in the northern zone.[38] The absence of matrilinear features from other parts of the Salmon Area indicate not only that they are relatively late but also that contacts between the north and the other regions of the area were broken for a long period.

If the claim of the northern culture to considerable antiquity rests on its extreme development of a unique social and ceremonial complex, that of the other regions of the Salmon Area depends on fragmentation. Despite impressive simi-

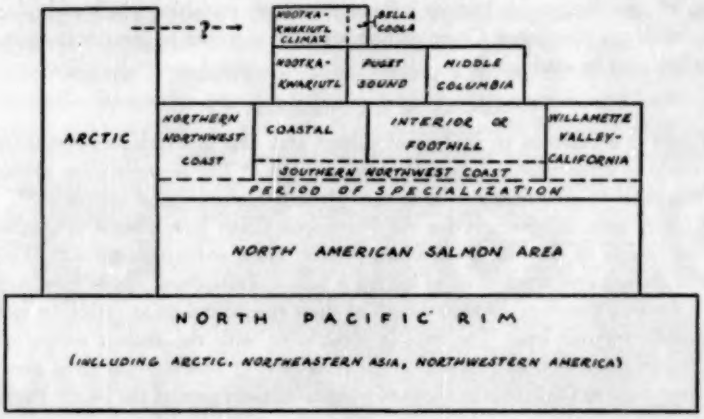

CHART II. The depth of Northwest Coast culture: from culture area designations (after Smith, 1952).

larities, various tribes of California, the Great Basin, the Plateau, and the southern Northwest Coast have always been assigned to a multiplicity of culture areas or subareas. As pointed out above, this diversity does not arise from any amorphous quality of their culture, but rather from their intensive local development and reworking of elements. Like the northern region, the southern developments require special treatment. Only for the Columbia-Fraser region lying between the northern and southern extremes have some suggestions of further cultural depth been attempted. (This *central* region is often called, probably to the confusion of non-specialists in the area, the *southern* Northwest Coast and corresponds to the western segments of the Columbia-Fraser region.)

At the level of the differentiation of the northern and Californian extremes, Chart II shows an Interior or Foothill region (see also below and Fig. 1). This

38 See also de Laguna, 1953; Honigmann, 1949, pp. 38-39; McClellan, 1953 and 1954.

was dated by linguistic evidence at 1500 or more years ago.[39] At that time Wakashan and Salish are said not to have been differentiated. Although such linguistic reconstructions remain to be confirmed, this date — which is the only one available for the ethnographic levels — shows an amazing correspondence with the estimate noted above for the Fraser climax. This correspondence of dates, so variously arrived at, probably influenced me toward tentatively accepting what is at best only an informed linguistic guess. Whatever its absolute date, the earliest level specifically discernible in the southern Northwest Coast seems to be that on which the present Wakashan and Salish areas are related through similarities in their social organization.

The 1952 analysis did not suggest that the Foothill region represented the only culture of the southern Northwest Coast at the time and the chart shows a contemporaneous coastal phase which presumably contributed toward the development of present Wakashan groups.

After the period in which Wakashan and Salish are postulated to have been in close relation, two levels are shown on Chart II. The first of these is that in which Wakashan developed its distinguishing linguistic peculiarities and certain of the social and ceremonial characteristics later to be elaborated. It was probably during this period that Puget Sound and the middle Columbia developed characteristics of their own and became peripheral to each other and to the Nootka-Kwakiutl region.[40] Although the 1952 analysis does not make this point, this would probably also be the period of Chinook-Wakashan ties largely responsible for the peculiarly northern-oriented development of some aspects of Chinook culture.[41]

The final period is that in which occurred the spectacular efflorescence of Nootka-Kwakiutl culture so clearly represented in the ethnographic horizon. During this period Bella Coola and Kwakiutl were in contact and Bella Coola received those traits which lead it to be grouped with Kwakiutl and Nootka in all culture area descriptions. At this time there are also clear indications of influences from the north. Ethnographic analyses do not yet make it clear to what extent these northern influences derived from northern Northwest Coast (such as matrilineal traces in the social organization) or from the Arctic or sub-Arctic. What is abundantly demonstrated is that the introduction of iron tools, or iron for tools, not only contributed to the wealth of the people but also led to intensified relations with groups of the northern Northwest Coast. It is likewise clear that the full flowering of the Nootka-Kwakiutl climax was due to the economic impetus gained

39 Swadesh, 1949.

40 Peripheral areas: "Areas of relatively the same cultural status . . . which remain in contact with each other . . . although each retains its identity . . ." (Smith, 1952, p. 93).

41 Particularly the third and fourth aspects isolated by Ray (1937). Ray's fifth aspect, which involved the introduction of the secret society, probably belongs to the last period on Chart II when northern contacts were intensified.

from European trade in sea-otter pelts. The northern ties are tentatively indicated on Chart II but the European or Western dimension has not been represented.

CHART III: PRESENT STAGE OF RECONSTRUCTION

Chart III represents a fusion of Charts I and II plus new data dealing mainly with the lower Fraser sequence. The greater complexity of the ethnographic strata are retained and this, coupled with a firm date for one set of Arctic contacts, presents a picture of greater cultural depth than had previously been assumed.

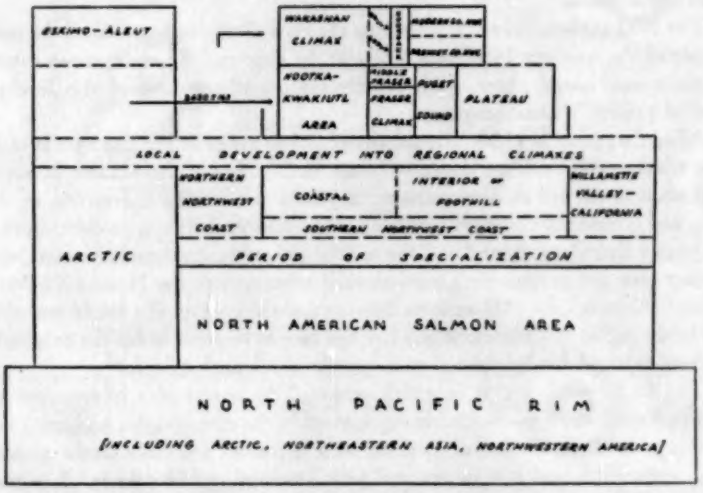

CHART III. The development of Northwest Coast culture (as now analyzed).

Northern Influences

The analysis of Arctic ties rests in part on the parallel tentatively postulated between the development of the Fraser climax and several Arctic climaxes. It is not assumed that these were any more than approximately contemporaneous. What they seem to represent are *developments parallel in complexity*. The processes involved in this period of specialization and in the period of local development into regional climaxes probably continued and the end products are not necessarily coexistent in any absolute sense. Chart III is thus as much a chart of suggested cultural processes as a picture of chronological strata. The assumption

that specialization precedes the local development of climaxes will probably not be seriously questioned, it being understood that differentiation continues throughout.

The elaboration of Arctic ties also partially depends on the first firm date for the Northwest Coast: a radiocarbon date of 2430 ± 163 years for the early horizon at Locarno Beach on the lower Fraser.[42]

The cultural remains at the Locarno Beach site, which once had a depth of almost fourteen feet, are described by Borden as existing in two strata.[43] He characterizes both of these as having strong Arctic affiliations and as being distinct from Marpole remains (Fraser climax). A further stage in this development of Arctic-related finds appears at the early level of Whalen Farm. Thus Whalen I is "assumed to be a later phase of Locarno Beach II"[44] and Whalen II, which is marked by a striking change in shell content and by frequent chipped projectile points and lamellar knife blades, represents a third tradition.

These are only preliminary statements of Borden's material, and one date for a fourteen-foot deposit is not very definitive. Nevertheless, the date for Locarno Beach I (the development of which is described at length by Borden) seems to agree rather startlingly with previous assumptions concerning northern, and possibly Asiatic, influences. These are shown on Chart I and were described as reaching the Columbia-Fraser region before 500 AD and then not again until the protohistoric period.[45]

Borden's other data may also be dovetailed into the sequence of Chart I. Whalen I looks very much like the prehistoric aspect of what was there called Late Bone. Borden speaks of the "victory of the northern slate grinding complex"[46] in the historic period, and this has been discussed in some detail in relation to ethnographic data.[47] South of the Fraser, of course, the distribution of ground stone is very limited although some elements of Late Bone occur as far south as the Oregon coast. Whalen II also fits the previous scheme as the Juan de Fuca interior-linked culture. This had not previously been cited east of Klallam, but its appearance at Whalen Farm in the delta area would tend to fill out the distribution, for it must be assumed that interior influences reached the straits by way of the Fraser. The position of Whalen II in a stratum above a prehistoric Late Bone stratum also agrees with the recency earlier deduced for the Juan de Fuca facies.

Interesting as this agreement between Borden's data and the conclusions of the 1950 survey is, it does not prove the validity of my reconstruction. It does go some

42 From tests run by Dr K. J. McCallum, reported by Borden (1954, p. 26; 1955).
43 Borden, 1950.
44 *Idem*, p. 24.
45 Smith, 1950a, p. 40.
46 Borden, 1950, p. 25.
47 Smith, 1950b.

way, however, toward indicating that most of the Fraser strata have been sampled. What is now needed is the careful establishment of relationships on systematic detail.

Chart III shows Arctic influences, dated by radiocarbon at Locarno Beach, of roughly 2500 years ago, affecting Columbia-Fraser sequences. Presumably these followed the open coast and had direct bearing upon the development of the Nootka-Kwakiutl area.[48] The Fraser climax is assumed to be somewhat later and to have been, in part at least, derived from this cultural contact which affected it less directly. The effects of this influence on Puget Sound and the Plateau may well have been filtered through the Marpole culture of the Fraser climax. The fact that these Arctic forces took so long to operate may possibly be understood in terms of a gradual infiltration of a relatively small number of Arctically-oriented people. This accords with other situations in the area which, until the later advent of the European, did not suffer from any sudden large migrations. Both Borden and Drucker[49] seem content to relate all of the Arctic and/or Asiatic ties of the Northwest Coast to contacts during this period which Drucker refers to as an old stratum. In doing so, however, they neglect data generally attributed to the ancient substratum. Thus Drucker mentions possible connections between Eskimo and Nootka masks and various other ceremonial traits. That such traits belong to this period is perfectly possible: that anything so complex belongs to an ancient substratum seems most unlikely.

The most recent stream of northern influence seems to have derived from the northern Northwest Coast after the definition of that region in the form known to ethnography was mainly complete. If there were Arctic influences at this period they must have been filtered through the northern Northwest Coast or to have been due, like possible Asiatic contacts, to sporadic direct contacts via open sea routes. The Wakashan climax seems to have been a response, as cited above, to these influences from the north and to later intensified contacts stimulated by European intervention. I would be surprised if the marked cultural acceleration of this final period of Chart III went back much farther than 1500 AD, and this may be giving it a hundred years too many.

48 Drucker has recently analyzed the Arctic springs of Nootka-Kwakiutl culture at some length (1955). He ascribes these to "Eskimo-Aleut" contact but since he believes them to be of some age, thus agreeing with the construction given here, the phrase seems to convey some inaccuracy. Certainly both Eskimo and Aleut must in their entirety be identified as modern cultures, and to project the terms into the past serves no purpose beyond indicating two possible routes of influence. His analysis of similarities between Arctic and Nootka are extremely important and are accepted in this reconstruction.

49 Borden, 1950, 1954; Drucker, 1955.

The Middle Fraser: position of the Nooksack

The Middle Fraser culture takes its name from the middle Fraser River in connection with which it was first identified. The term was first used as a convenient way of referring to certain distributional data,[50] and only later described as a prehistoric culture area or province.[51] The culture is thought to be represented historically only among the Nooksack, who form a linguistic pocket in the midst of other Coast Salish languages; but also to have been maintained by the Chilliwack until the time of intensive European contact. Suggestions as to the existence of this early culture seem not to have been generally understood,[52] largely perhaps because attempts to establish ethnographic levels in time are so uncommon. Middle Fraser culture is described as having preceded the historical northern influences (Halkomelem; slate-grinding) on the middle Fraser, and as having grown out of the still earlier Fraser climax. This sequence is shown on Chart III. One value of the hypothesis is the explanation it offers of the previously anomalous position of the Nooksack.

One of the strange effects of the wide acceptance of the culture-area concept in American anthropology has been a kind of permanent fixation on timeless areas defined by ethnographic data. Thus, because Yale on the Fraser River marked a satisfactorily definite line between Interior and Coast Salish on the historic level, this boundary was carried back into the past. Because of this, discussions of the interior or coastal origins of Pacific Coast culture have functioned with rigid concepts of "interior" and "coastal." An obvious way out of the contretemps, and one which has the more important advantage of evolving from the data, is to redefine areas in depth. Recognition of a prehistoric Foothill or Interior province would realign certain Fraser sites linked with the Interior Salish in the historical period: Lytton, for instance, which is now Lower Thompson would become Middle Fraser on the next lower level. "Thompson" would presumably lie farther upstream if it could be identified at all.

50 Codere, 1948; Smith, 1947.

51 Smith, 1950b.

52 Although he questions the hypothesis, Duff (1952) actually proffers data in its support. His discussion of pit houses (pp. 46-47) confirms that pit houses were not only distributed down the Fraser in relatively recent times but were well-known on the western slope of the mountains in a distribution continuous with that of the Plateau. The "opposing theories" he mentions (p. 12) are not opposing at all. There is every reason to believe with Boas that the physical type is old in the area, and with Hill-Tout that the Halkomelem language is relatively new. Neither of these theories, nor the one discussed above, necessarily involves either "migrations" or "earlier populations" as he seems to think. The whole history of the area is closely tied to the gradual diffusion of traits. See also Barnett, 1938; 1944; 1955.

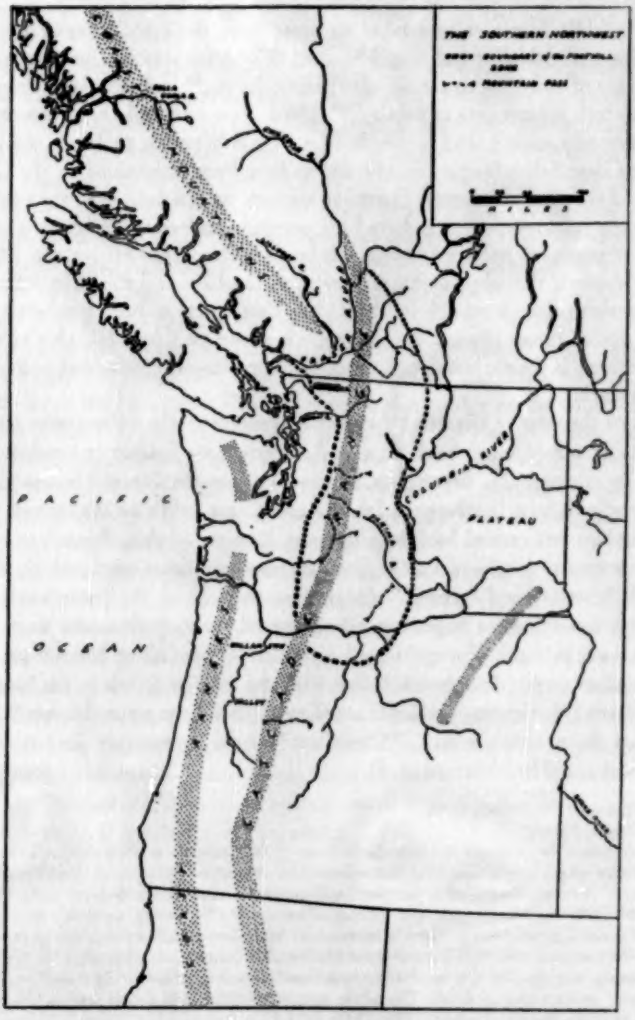

FIG. 1. Map of the southern Northwest, showing the area of the proposed Foothill Province.

A PREHISTORIC FOOTHILL PROVINCE

Although attempts have been made to recreate early trait assemblages for the middle Fraser, the existence of a Middle Fraser culture defined by these assemblages is not necessarily involved in the Foothill or Interior province. This province is a pure outgrowth of culture-area mapping techniques, performed in the classical manner without specific reference to cultural depth. The map of the southern Northwest (Fig. 1) shows the approximate boundaries of this province or zone. The northern limits have been left undefined until they can be established with greater precision than is now possible.

Origin of the Bella Coola

The apparently obvious explanation of the origin of the Bella Coola — who form an isolated Salish pocket in the north — from Gulf of Georgia Salish has always run into the snag that they are less like these Salish in either language or culture than like Coast Salish farther to the south. The distance between them and the Gulf of Georgia has also been increased by McIlwraith's confirmation of Boas's early data placing them on the upper reaches of their salt-water estuaries.[53] If the Foothill province extended north through parts of the Lillooet drainage, an easy route was available for the northern emergence of the Bella Coola. The Bella Coola would thus represent the northernmost extension of the province, the people having arrived at their present location by a process directly paralleling the slow down-river infiltration which marked the western advance of more southern Foothill groups.

Just as the Middle Fraser culture is assumed to have been largely overlaid by northern traits, so the Bella Coola in their new position absorbed Kwakiutl influences. These may have come slowly at first, the process then accelerating under the impact of the Wakashan climax in which, at the end, the Bella Coola actually shared and to the creation of which they may even have contributed.

Distribution of Stone Sculpture

Discussions of coastal-interior relations have often centered around the distribution of carved stone and the origins of the Columbia valley art style. Various theories as to the distribution of this complex[54] have been handicapped, as Caldwell points out,[55] by the fact that stone carving is restricted to the lower and middle reaches of the Columbia and Fraser Rivers. The complex is certainly a

53 See corrected map of Bella Coola territory (Smith, 1952, fig. 1). Barnett also notes their mythological memory of underground houses — a Middle Fraser trait (1944, p. 265).

54 Borden, 1954, pp. 29-30; Smith, 1950b, pp. 26-27.

55 Caldwell, 1954, p. 23.

generally up-river tradition, but reconstructions tying the Fraser and Columbia art styles by an "interior" lane of communication, i.e. an east-of-the-mountain lane from upper Fraser to middle Columbia, have been open to question because of discontinuous distributions.

A recent survey of Columbia-Fraser stone sculpture links a Fraser River with a Puget Sound style,[56] but it is not clear from the data whether the stone sculptures cited for Puget Sound derive only from the Nooksack and Lummi valleys or have also been located farther south. The former derivation is certainly the one with the best supporting evidence. The next style center to the south appears in the Yakima-Vantage area in the eastern foothills. What is needed, therefore, is a lane of communication between the Nooksack valley and the Yakima region.[57] A glance at the map (Fig. 1) shows that the passes across the Cascades lead east from the central Puget Sound region. Snoqualmie Pass, which affords the easiest path across the mountains, forms a direct route to the Yakima River, and a pass also links the Yakima and the middle Columbia regions. Access was thus given from the Nooksack to the Yakima and a perfectly feasible route existed between the middle Fraser and the middle Columbia.

One of the great advantages arguing in favor of this route is that the ecological conditions remain constant for its entire length. The only gap in the distribution of stone sculpture plotted along it is in the Central Puget Sound. Although there is no certain evidence for the existence of stone sculpture there, it is extremely interesting that an exhaustive study of Salish wood sculpture places its probable point of origin "inland or up-river rather than coastal" and suggests that specimens from the Duwamish of Central Puget Sound "reflect the older features of Salish style."[58] Since artifacts of the Fraser climax include wood-working tools similar to those used in historic times by the Coast Salish, the possibility that carving extended to wooden objects which have since disappeared seems highly plausible. Whether the work in stone and bone formed one source of historic Salish sculpture can only be demonstrated by stylistic features. In any case, an up-river or inland route for massive stone carving which does not involve any high Plateau areas is available in the foothill region.

The Foothill province seems not only to meet the need for a route of distribution between middle Fraser and middle Columbia but it also aids in understanding the relatively limited distribution of stone carving. Fraser stone carving has always been associated with the Fraser climax (Marpole) and consequently given some historic depth. The Columbia valley art style, on the contrary, has never been

56 Wingert, 1952.

57 Harlan I. Smith thought the middle Fraser and Yakima valley were closely related (1899b, p. 161), and Drucker (1943, p. 118) feels that this relationship is significant.

58 Wingert, 1949, p. 119.

regarded as very old. If the climax developed within an area of some homogeneity, i.e. the Fraser climax within the Foothill province, it would have tended to facilitate a subsequent borrowing in the same area, surrounding regions with different basic traditions being less apt to accept it.

Significance of the Foothill Province

The hypothesis thus seems to provide the basis for a simple and satisfactory explanation of both Bella Coola origin and the distribution of stone sculpture. It may be briefly summarized as follows: a Foothill or Interior province occurred in the foothill regions of the Cascades and the Coast Range, on both sides of the mountains from the upper Lillooet to the Dalles; the Bella Coola represent a migrational drift from the northern end of the province; and the region is characterized by an art tradition including stone sculpture.

If a further step be taken and the province is placed in historical perspective according to the reconstruction of Chart III, certain assumptions may also be made concerning it: the character of the province was defined by approximately 2500 years ago; the Fraser climax developed within it under stimulation from the interior (via the Lillooet and Fraser drainages) and the north (via such contacts as Locarno Beach); stone sculpture is associated with the Fraser climax and traveled south through the province, arriving at the Dalles in the protohistoric period.

Light is also thrown on certain other distributions: Puget Sound probably owes its basic orientation to the old culture of the Foothill province, northern Northwest Coast traits such as the ceremonial potlatch and the secret society having been introduced by a process paralleling their introduction to the Chinook. Since the route between the northern groups and Puget Sound was not so direct as to the Chinook, however, its adaptation to northern cultures never advanced as far.[59]

Although the historical Plateau may have owed much to the Foothill province, other influences were certainly at work there and I would expect to find a province roughly contemporaneous with it in the region of Ray's old center of Plateau traits.[60] Both interior northern and interior southern influences must be expected for the Plateau. That there were Southwest-Plateau contacts (probably indirect) is attested by the recent discovery of two maize kernels in a middle Columbia cave, the horizon from which they were recovered being tentatively dated at c. 1300 AD.[61]

59 See Ray (1937) for development of several of these points.

60 Ray, 1939, p. 149.

61 Swanson, n.d. It should be added as a further caution that this horizon is the least assured of Swanson's horizons.

Final confirmation of the developmental sequences reviewed here must naturally wait on the establishment of valid archaeological sequences and the plotting of traits over wider areas. There seems no reason, however, for these two activities to operate with different standards of time depth. The comparative method is essential to both archaeology and ethnology and in both inference and fact go hand in hand. Although the organization of archaeological data into levels may occasionally cloud the gradual development of traits, clearly defined strata are found at certain sites and the establishment of cultural strata generally conforming with these in concept has proven fruitful. The partial reconstruction of Northwest Coast history given here also makes use of a parallel organization of ethnographic data into levels. Such arrangements of ethnographic material are still in the explorative stage. If they grow in importance it will probably be because of the fact that they yield a manner of handling time which is directly comparable with that employed in archaeology.

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ON SOIL COLOR AND TIME

GEORGE F. CARTER

STUDIES in Pleistocene geomorphology in relation to the antiquity of man in Southern California have included color notation of natural soils and soils developed on human habitation sites. The scoring has been done by means of the *Munsell Soil Color Charts, Special Form for Use of Soils Scientists, Geologists, Archaeologists*. Relationships have been found between soil color and time. This makes it possible to place archaeologic soils in a geologic weathering scale by means of color scoring.

Soils are highly variable. The major variables are: parent material, slope, vegetation, climate, and time. The problem is to control this complex of variables in such a way that one, in this case time, is the major variant. In this study, this is approached by limitation of the study to a small geographical area of limited source material, and restriction of sampling to gently sloping well-drained sites with grassy to brushy vegetation. The limitation of area automatically controls the climatic variation and to a considerable extent controls both the parent material and the vegetation. For example, in the San Diego area, the samples were all taken on sandy alluvial materials. The adobe clay soils developed on limey phases of the local geological formations were omitted. The majority of the samples are from a coastal strip five miles wide, twenty miles long, and from river and valley terraces beneath 100 feet elevation. In this narrowly restricted environment, with the addition of further restrictions as to sites sampled, variables are reduced to a minimum.

The vegetation in this zone is open stands of short brush, the well known "chaparral." The rainfall is ten inches per year, and strongly concentrated in the winter season. The temperatures are extremely even, January 54, July 67. Even light frost is virtually unknown and summer heat is prevented by the presence of a low stratus cloud cover.

The quantity and distribution of samples to be discussed here are as follows: from the San Diego area 176, from Santa Rosa Island, Santa Barbara County 48, from Baja California 14, Miscellaneous California 8. Of these samples C-14 dates are available for six profiles. The San Diego material was collected from 1947 to 1950 during terrace studies. The samples from Baja California were collected while on a field trip with Dr Carl Hubbs of the Scripps Institution of Oceanography in 1954. The Santa Rosa Island samples were obtained in 1955 during an expedition to that island sponsored by Mr Phil Orr, acting jointly for the Santa

Barbara Museum of Natural History and the Western Speleological Institute. I am indebted to both Dr Hubbs and Mr Orr for their coöperation. Mr Orr has also made available unpublished data, such as C-14 dates for Santa Rosa Island.

The air-dry samples were prepared and scored by student assistants using interior north light and the Munsell charts. These charts contain approximately thirty color chips for each hue from 7.5R to 5Y. A color card was prepared for each sample by coating an adhesive-smeared card with soil. The soil cards were then arranged in vertical sequences as they occurred in nature. The sets were laid out on tables and sorted by location. Thereafter, trial runs were made of various sortings with the data entered on scatter diagrams with varying axes. The more pertinent of these diagrams are illustrated and discussed below.

A few general statements concerning color distributions can be made that give an idea of the range of colors to be dealt with. The majority of the samples are of the 10YR hue. On the black-to-white scale 98% of the samples are near mid-scale (4-5-6) and of these, 50% are 5. Parent materials are much lighter (7 and 8) and middens and hearths are darker (3 and 4). In terms of color saturation, 94% of the soils are 2-3-4. The strongly color-saturated soils (6-8) are B horizons of old terrace soils. Breakdowns by elevation, location, natural versus site soils, and so forth are presented below.

At San Diego, parent materials in the restricted coastal alluvial belt to which these observations are confined are remarkably uniform. There are Eocene sands and conglomerates, overlain by Pliocene marine sands and conglomerates. These deposits have been terraced by marine action on their seaward faces, and dissected by streams descending from the inland mountain area. The stream valleys contain a complex of sandy valley fills which introduce alluvial materials derived from weathering of granitic materials from the interior ranges. The parent materials involved in this study are largely reworked materials from this rather simple sedimentary zone.

The parent materials score very light. (See Fig. 1 and Table 1.) The sands are nearly colorless but faintly yellow. The Pleistocene alluvium derived from the erosion of these materials mixed with the soils developed on these parent materials is slightly darker. There is no change in parent material color with elevation, or with change in terrace. The only significant variation observed was that some of the finer river alluvium was dark (10YR, 6 or 7) and that some of the alluvium deposited over the Pleistocene beaches was also this dark. The maximum deviation from this is a single sample of modern dark silt. (See P-10 in Fig. 1.) Such dark variants represent the inclusion of darker weathered materials, and some weathering and humus accumulation during deposition. This is particularly clear in the alluvial cover south of the University of California campus at La Jolla. Where

alluviation was rapid, stratification is preserved and the color of the material is light. Where alluviation was so slow that no stratification was preserved, the colors are darker. The uniformity both of type of parent material (a narrow range of sandy alluvium) and the uniformity of color are important to this study since they

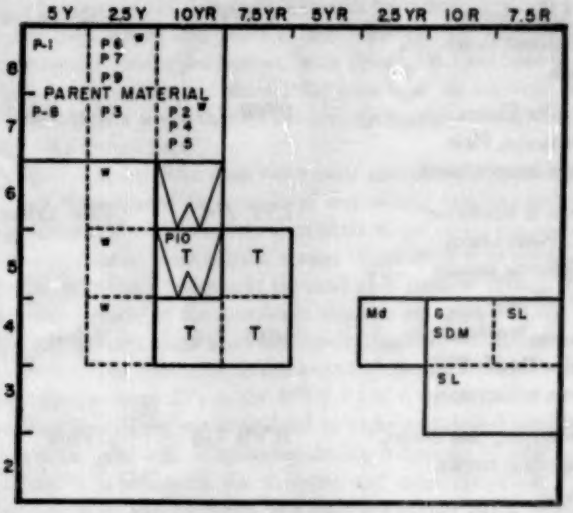

FIG. 1. The axes of this figure are Hues from yellow (Y) through orange (YR) to red (R), and Chroma (1 equals black and 10 equals white). The progression shown is from very light yellowish parent materials to dark red weathered soil materials. Typical parent material samples are numbered and data for them are placed in Table 1. The large W's designate the squares that include 90% of the soils of the alluvial covers over the last interglacial beach, and the small w's express the scatter. These represent fragments of Wisconsin weathering-time. T's mark the squares containing 75% of the soils that express all of Wisconsin weathering-time. The squares in the lower right hand corner represent old soils as follows: Md, Maryland 100 foot terrace in sands; G, Georgia red clay at 200 foot level; SDM, San Diego on the Pliocene surface above 300 feet; SL, Siamese laterite of probable pre-Pleistocene age.

establish a relatively uniform base from which divergences due to weathering may be measured.

Approximately one half of the San Diego samples scored were from alluvium accumulated over the Pleistocene beaches about twenty-five feet above present sea level. This beach is considered to represent a late third interglacial sea stand. The alluvium accumulated over it is, therefore, allocated to the time of lowered sea

TABLE 1

Parent Materials at San Diego

P-1	La Jolla Shores Pleistocene Beach Sands	5Y 8/4	Pale Yellow
P-2	La Jolla Shores Pleistocene, Pleistocene terrace cover	10YR 7/4	Very Pale Brown
P-3	Curtis & Rosecrans Sts., Point Loma, Pleistocene terrace cover	2.5Y 7/4	Pale Yellow
P-4	Diamond & Noyes Sts., Pacific Beach, Pleistocene terrace cover	10YR 7/6	Yellow
P-5	Market St., San Diego, Pleistocene terrace cover	10YR 7/6	Yellow
P-6	Logan Ave., Pliocene sandstone	2.5Y 8/6	Yellow
P-7	Torrey Pines, Eocene sands	2.5Y 8/2	White
P-8	Overlook, San Diego, Eocene sands	5Y 7/2	Light Gray
P-9	La Jolla beach sand	2.5Y 8/2	White
P-10	Wabash Ave., Recent fine silty alluvium	10YR 5/2	Grayish Brown

levels of the last glacial stage. This was a time of increased rainfall at San Diego. This conclusion is supported by the character of the soils developed in and on this alluvium: acid in their upper levels, lime accumulating at a depth of thirty inches or more, sandy soils often contain incipient iron concretions, and so forth. All of these features suggest a more humid climate such as would have been found in these alluvial covers; a C-14 date of 21,500 years has been determined for an upper level of this alluvium at one point in the University of California campus.[1] Alluvium in exactly similar position on Santa Rosa Island has been C-14 dated at 29,500 years in mid-section and about 7000 years near the surface.[2] The alluvial terrace covers are as a whole then Wisconsin age features though the uppermost levels reach into Recent time.

The alluvium at La Jolla does not record unbroken Wisconsin weathering. The material accumulated in a cycle of deposition, erosion, and weathering. Numerous minor cycles and not less than three major cycles are recorded in the exposed cross-sections of these alluvial covers. Weathering time for any single soil stratum can then be but a fraction of the total of Wisconsin time. It is significant then that ninety percent of the samples in these covers score 10YR 6/3 to 4 and 5/3 to 4. Descriptively, these are Pale Brown, Light Yellowish Brown, Brown, Yellowish Brown. The exceptions to this score lighter. These data are expressed in Figure 1 by the two large W's in the 10YR 5 and 6 squares. The exceptions are plotted as small w's. They are considered to represent virtually unweathered to slightly weathered alluvium. Weathering during fragments of Wisconsin time is expressed then by increases on the darkness and color saturation scales and a parallel increase in redness expressed by a shift toward the 10YR scale.

When specific sets of samples are considered, it is found that they fall into narrow color ranges. The youngest alluvial cover in the La Jolla embayment (University of California campus to the Beach Club) was sampled in depth in the sea cliff, and by drill rig as well as from surface sampling. The thirty samples were all but three on the 10YR scale; the exceptions were on the 2.5Y and 5Y scale (2.5Y 6/4) and 5Y 8/4). The samples were sharply concentrated in the 10YR 5 to 6/3 to 4 range. "A" horizons were significantly lighter. A set of samples from La Jolla Hermosa, an alluvial cover of similar geomorphic history, scored the same.

Three soil columns are given in Table 2. The alluvial column from La Jolla

1 Meyer Rubin and Hans E. Suess, *U. S. Geological Survey Radiocarbon Dates II* (Science, n.s., vol. 121, pp. 481-488, 1955).

2 P. C. Orr, *Radiocarbon Dates from Santa Rosa Island* (Bulletin, Department of Anthropology, Santa Barbara Museum of Natural History, pp. 1-8, 1956).

TABLE 2

Soil Colors for Alluvial Cover Material over the Last Interglacial Beaches

1	*2*	*3*
10YR 4/2 Dk Grayish Brown	2.5Y 4/2 Dk Gray Brown	10YR 6/3 Pale Brown
10YR 3/3 Dk Brown	10YR 6/3 Pale Brown	10YR 5/3 Brown
10YR 4/3 Dk Brown	10YR 5/3 Brown	10YR 6/4 Lt Yellowish Brown
10YR 6/4 Lt Yellowish Brown	10YR 5/4 Yellowish Brown	
10YR 7/4 Very Pale Brown		
10YR 7/4 Very Pale Brown		
10YR 5/4 Yellowish Brown		
10YR 5/6 Yellowish Brown		

1 Column through the alluvium at La Jolla Hermosa, to a depth of twenty feet.
2 Soil Profile from alluvial fan south of U. C. Campus, La Jolla
3 Soil Profile from alluvial fan south of U. C. Campus, La Jolla

Hermosa contains a complex record of weak profile developments buried by subsequent depositions. Note the failure of descriptive terms to discriminate between different colors such as 10YR 3/3 and 10YR 4/3. Columns 2 and 3 give the A, B, C horizon color-sequences for surface soils on an alluvial cover. The preparation of the samples has decreased the color contrast seen in the field, for the B horizons are structured and dark coloring matter is concentrated on the faces of the cubes and columns. Cleavage along these faces exposes the dark surface coatings. This gives a darker appearance to these horizons in the field.

Older Soils

In distinct contrast to these samples alluvium from river terraces, marine terraces (up to but not including the 100 foot terrace), where the materials were less subject to cycles of erosion and deposition, scored significantly differently in their A and B horizons, though their C horizons were the same as for the alluvium just discussed. Materials from these locations were darker, more color-saturated, and redder. Had materials from the 100 foot terrace been included, they would have scored significantly redder than these samples.

Out of 43 samples, only 11 were outside the square defined by 10YR and 7.5YR 5 and 4. (See Fig. 1, where these squares are marked by large T's.) The eleven exceptions are composed of 6 C horizon samples that are lighter than this, and 5 B horizon samples that are redder. Within the square, it is noticeable that A horizons are darker, and the B horizons redder. In the 10YR half of the square, the A and B samples are equal in number, but only A horizons score in the darker, 10YR 4 sector. On the 7.5YR half of the square, the A horizon samples decline to twenty percent. Only B horizons are redder than 7.5YR.

Typical profiles are given in Table 3. 1700 Logan Avenue is on the edge of San Diego Bay and the elevation is approximately fifty feet. Old clay pan soils exist here that show complex histories of salinization and desalinization. This soil probably represents all of Wisconsin weathering time at a minimum. The Solana Beach sample is from a dune sand ridge one hundred feet high, which overlies a Pleistocene beach at about twenty-five feet elevation. It probably represents all of Wisconsin weathering time in dune sands.

The complexity of soil sequences to be found in and on seemingly simple landforms is well illustrated on Crown Point. This landform is a terrace remnant projecting south from Mount Soledad into Mission Bay. Sections exposed on its sides show that it is composed of two sand deposits of varied degree of weathering, separated by a cobble ramp recording a period of high sea stand. The older sand is in turn separated by another cobble ramp from a still older soil, which was formed on an older more eroded land surface now buried by the sands. (See

Fig. 2.) These age relations are stratigraphic. They are accompanied by increases in redness, consolidation, and clay accumulation with increasing stratigraphic age. Two sea stands of the magnitude of fifteen to twenty-five feet are implied by the cobble ramps. The earlier of these is probably late last Interglacial, and the other possibly of inter-Wisconsin age. The 5YR soil would seem therefore to be a pre-

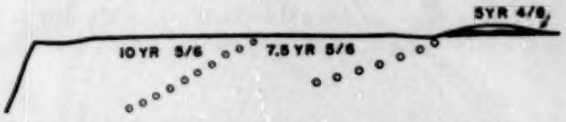

FIG. 2. A north-south section through Crown Point. This is a Pleistocene terrace feature which represents filling during high sea stands of the San Diego River mouth. The lines of circles represent cobble ramps. The soils are progressively older from left to right and the reddening progresses in the same direction. Cementation, depth of weathering, clay mineral formation, granite weathering, all parallel the color change.

Wisconsin soil. Its very strong clay pan development and strong coloration suggest a humid climate, and weathering during Illinoian time seems likely.

Similar superpositions and inclusions are frequent in the San Diego area. The north end of Point Loma, on the opposite side of the Mission Bay, repeats the sequence of superimposed young brown sands, redder sands, and at a higher eleva-

TABLE 3

Typical Profiles of Older Alluvium

1700 Block Logan Avenue, San Diego	
10 YR 4/4	Dark Yellowish Brown
7.5 YR 5/6	Strong Brown
5 YR 5/8	Yellow Red
10 YR 6/3	Pale Brown
2.5 YR 8/4	Pale Yellow
Solana Beach, San Diego County	
10 YR 4/4	Dark Yellow Brown
7.5 YR 4/4	Dark Brown
10 YR 5/6	Yellowish Brown
10 YR 5/4	Yellowish Brown

tion red clay pan soils. A similar sequence is present at Wabash Avenue on the San Diego Bay edge.

The low terraces at the mouth of the Sweetwater River in south San Diego Bay also show this sequence of a younger sand deposited over the lower end of an older, more weathered sand, and with red clay pan soils developed on the adjacent higher terraces. In this area there are reddish cemented sands now being drowned by the rising sea levels of modern times, and these sands can be traced out beneath the muds on the bay floor. A renewed glacially-lowered sea level would expose them as reddish inclusions in a later "valley fill" of less red color.

Relatively few samples were taken from the higher terraces. They are supplemented here by the inclusion of a Georgia red clay and a Siamese laterite both of

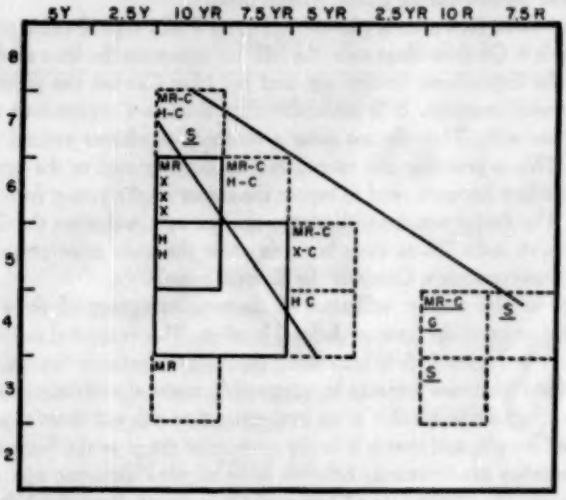

FIG. 3. The squares ruled in solid lines indicate the areas shown in Figure 1. The diagonal lines enclose the broad zone of colors associated with ancient extreme weathering.

Old soils that probably began weathering during Pliocene time. These are modern surface soils and their surface horizons colors tend to be those of young brown soils. Their deep horizons show a great range of colors. Although most of these horizons are designated as C, none of them is unweathered. The ancient deeply weathered materials are now acting as parent material for the present soils, but the great diversity of color including real reds are indicative of strong humid weathering in the past. Compare the Siamese laterite colors (S) with those from the 300 foot surface in San Diego (MR).

X, Experiment Station, Torrey Pines Mesa; MR, East of Marine Rifle Range; H, Head of Hog Canyon; S, Siamese laterite; G, Georgia red clay.

probable pre-Pleistocene weathering age. The terraces higher than 250 feet in the San Diego area are pre-Pleistocene. They are remarkably well preserved and have strongly developed soil profiles. Of most interest to this study are the soils developed on well-drained sandy ridges on these ancient surfaces. These approximate the well-drained, sandy alluvium soil environments of the adjacent lower terraces. Weathering has penetrated these sands to depths of fifty feet or more and where erosion has not removed it in subsequent time, an iron concretion-rich capping, underlain by strongly cemented, mottled red (10R) sand, remains on these ridge tops. In rare instances, where erosion has been virtually non-existent, a light colored sandy A horizon overlies the iron-accumulating horizon. Where sheet erosion has been even slightly active, the bleached horizon is absent. Where a higher degree of erosion has exposed relatively fresh sands to the weathering environment, clay pan soils have formed during glacial pluvial times.

Data for three such soils is plotted in Figure 3 and typical color profiles are given in Table 4. Of these three soils, the MR set represents the least eroded condition. Both the Experiment Station site and the Hog Canyon site represent considerably eroded locations. It is noticeable that there is a tremendous spread of colors in these soils. They do not show a tendency to cluster around one focal color area. This is probably due to two factors, both related to the age of these soils. The surface horizons tend to repeat the colors of the young brown soils of the region. The deeper weathered horizons are in a very real sense the C horizons for these brown soils. These deep horizons show the wide color range common to old weathered materials. Compare the Siamese sample.

In order to plot a color indicative of the weathering age of these soils, the dominant red color of the least eroded soil is taken. This is entered as SDM (San Diego Mesa) in Figure 1. It is interesting that this is distinctly beyond any color scored on the Pleistocene terraces in comparable material and location, and that it is closely comparable in color to an iron concretion-rich soil from a comparable elevation in Georgia, and that it is in the same color range as the Siamese laterite. The true laterites are commonly believed to be of pre-Pleistocene age. A further point in Figure 1 is supplied by a Chesapeake Bay sample from the 100 foot level at Brooklyn, Maryland. This is from a sand deposit of probable mid-Pleistocene age. The sands at this Maryland location repeat the San Diego color sequence: light yellow parent materials, brown young terrace soils, and increasing red with greater elevation. The sample scored here is from the 100 foot terrace.

The Siamese laterite is very useful for this comparison. The sample is a brick from a temple wall. The dominant colors are dusky red and red, but there are mottlings of yellow. Nor would this be the total range of color in a laterite profile. Palliid zones, flame red zones, light mottling colors are all expectable.

These deeply weathered materials at San Diego reflect some ancient condition much wetter than the present. This is shown by the depth of weathering, the rootcasts and mottlings at depths not now penetrated by roots, by the kind and degree of iron movement and by the color. The present ten inch rainfall is incapable of weathering even sands to fifty foot depths. For example, sandy terrace surfaces exposed during Pleistocene pluvial times to rainfalls greater than now are weathered only to depths of five feet. The modern vegetation on the Pliocene sands do not send massive roots to twenty foot depths, yet large root casts occur at these depths. The immense deposits of iron concretions find their parallels in humid southeastern United States at equivalent elevations, and in tropical humid lands

TABLE 4

High Terraces

East of Marine Rifle Range

A	10YR 3/3
B	10YR 6/3
C	10YR 7/4
C	10R 4/6 mottled with 7/5YR 6/2

Experiment Station

A	10 YR 6/3	Pale Brown	Carlsbad soil
B	10 YR 6/4	Light Yellowish Brown	Carlsbad soil
C	10 YR 6/3	Pale Brown	Carlsbad soil
C	10 YR 6/6	Brownish Yellow	Sweitzer Sands
C	5 YR 5/6	Yellow Red	Sweitzer Sands

Hog Canyon

A	10 YR 5/3	Brown
B	10 YR 5/8	Yellowish Brown
C	10 YR 7/1	Mottled light gray in reddish brown
	5 YR 4/4	Mottled light gray in reddish brown
	7.5 YR 6/6	Reddish Yellow
	7.5 YR 5/8	Strong Brown

Note: None of the soil columns penetrated to unweathered materials.

where they represent an old age stage in soil weathering. See, for instance.[3] This range of colors is then a measure of great weathering age under humid conditions, and furnishes a standard for both Figures 1 and 3.

When archaeological site soils are plotted on the same scale as Figure 1, little

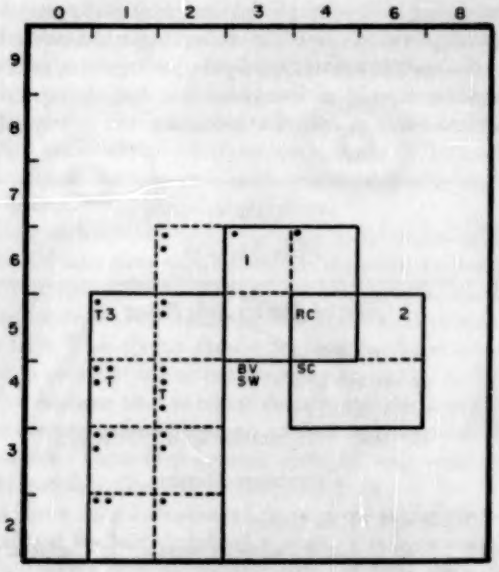

FIG. 4. 10 YR hue with chroma arranged on one axis as in Figures 1 and 3 but with color saturation within the 10 YR hue placed on the other axis. Squares 1 and 2 represent the areas enclosing colors characteristic of fragments of Wisconsin weathering and of all Wisconsin time respectively. The rectangle numbered 3 encloses most of the young site soil colors. Individual sites are indicated by dots. Letters indicate older site soils. Younger archaeologic sites. Riverside, 10YR 2/1 and 3/1, Baja California (C-14, 2500 years) 10YR 3/2 and 2/2. Santa Rosa Island, Late Dune Dweller, (C-14, 2500 years) 10YR 4/1 and 2/1. Highland culture, Santa Rosa Island, 10 YR 4/1, 3/1, 3/2. Santa Rosa Island, Canalino culture, C-14, 1860 years, 10 YR 5/1, 5/2, silt lens as unmodified matter 10YR 6/2. Rose Canyon, Diegueño, historic at surface 10 YR 3/2 and 4/2, La Jolla at Beach and Tennis Club, upper midden historic Diegueño at surface 10 YR 4/1, sterile zone 10 YR 6/3, bottom midden 10 YR 4/2, Midden on Torrey Pines Mesa 10 YR 6/2 A horizon, 10 YR 4/2. Hearth in gully through alluvium south of Scripps Campus, C-14 600, 10 YR 6/4. This color is wrong for this date and may be due to somewhat weathered materials deposited on the hearth. Older sites: BV, Bayside Village; SW, Sweetwater river, north side; RC, Rose Canyon, old midden.

3 E. C. J. Mohr, *The Soils of Equatorial Regions with Special Reference to the Netherlands East Indies* (translated by R. L. Pendleton, Ann Arbor, 1944), frontispiece.

can be discerned except that the younger sites tend to be dark and the older sites tend to be yellowish and to fall in the area of overlap between the alluviums recording parts of Wisconsin time and all of Wisconsin time. What occurs in the weathering of site soils is brought out better by plotting the colors on the 10YR scale.

Color values for a number of late archaeological site soils on the 10YR Scale, are as shown in Figure 4, and the data are presented in Table 3. The archaeologic sites consistently score darker than natural soils. The sites may be briefly commented upon. The Riverside site is buried by light colored alluvium. The dark color represents an occupation area enriched by man and stained by the humus accumulation resulting from the increased plant growth. The Baja California 2500 year site is a shell midden whose color reflects the same effects. The Santa Rosa Island 2500 year site is a thin shell midden in a sand dune. The samples came from a possible temescal location very rich in charcoal. Highland, Santa Rosa Island samples represent camp sites with moderate amounts of shell. They are considered by Mr Phil Orr to be intermediate in age between Canalino and the Red Abalone period. The latter period dates 6000 to 8000 years ago by C-14. Except for the possible temescal site sample, these dark colors do *not* seem to be due to charcoal.

The late Canalino site, C-14 dated at 1860 years, provides exceptionally significant data. This location is composed of a group of circular house pits with deep rubbish heaps about them. The midden accumulated sufficiently rapidly that sea grass thatching and cordage was buried before it could rot. The present climate (rainfall about ten inches) has not supplied sufficient moisture in 2000 years to rot this material now buried at a depth of approximately thirty inches. Since the midden is loose and porous, penetration of rainwater should be above average for sandy alluvial soils. Sites of denser materials in which perishables are rotted at greater depths suggest either greater rainfalls in earlier times or slower accumulation of debris. The absence of any traces of lime migration is striking. The color of the midden is light. A thin silt layer divides the midden and supplies an excellent parent material comparison. It is one degree lighter than the midden.

These data suggest that the midden accumulated relatively rapidly and that ash and charcoal did not greatly darken the material. Extremely little weathering occurred during or since the accumulation. The contrast with the very black Highland middens is striking.

Colors for two late middens at La Jolla were recorded in the field. As will be discussed below, the field notations differ from the laboratory. However, for these middens the color values seem to agree with the laboratory, and they are included in Figure 4. The upper of the two middens at the Beach and Tennis Club produces arrow points and pottery in its upper few inches. Nothing is known of the cultural content of the lower midden, but expectably it contains manos, metates, cobble

flake and core tools. The sterile zone between the two middens scores in the Wisconsin alluvium zone and the middens score significantly darker. I remember the lower midden as being yellower than as scored here, but lack any samples by which to check the point, and hence am unable to determine whether my memory is faulty or whether my inexperience with color charts has introduced an error here. The

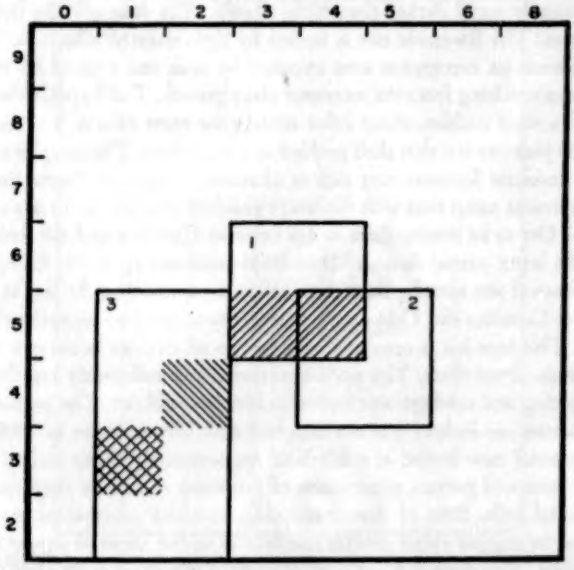

FIG. 5. Rose Canyon Middens: 10YR Hue Squares 1, 2, 3 are as in Figure 4. The ruled areas are: *oblique, up to right,* Old buried midden; *oblique, up to left,* Younger surface midden; *cross-hatched,* Charcoal rich hearth in younger midden. These are the standard color shifts for dense habitation sites.

Torrey Pines midden is on the property of Mr Black. It is pre-pottery and pre-stone arrow point occupation, and its base is strongly lime cemented. The site is rich in manos, metates, and cobble flake and core implements. The lime cementation at the base exceeds that of sites on Santa Rosa Island dated at 6000 to 8000 years, and the development of a distinctly lighter colored A horizon also indicates that weathering at this site is somewhat advanced over the other site soils included here. In Figure 5, color data is plotted for one site where a late midden overlies an old midden. From the overlying midden a sample was taken from a hearth.

As can be seen, there is a steady loss of black and gain in color saturation from the young hearth to the older midden. The older midden is now of the color of a soil which has weathered from normal alluvium. Yet, it began weathering as a dark site soil strongly enriched with chemicals due to man's occupancy.

Some idea concerning antiquity for such weathering can be gained from a site

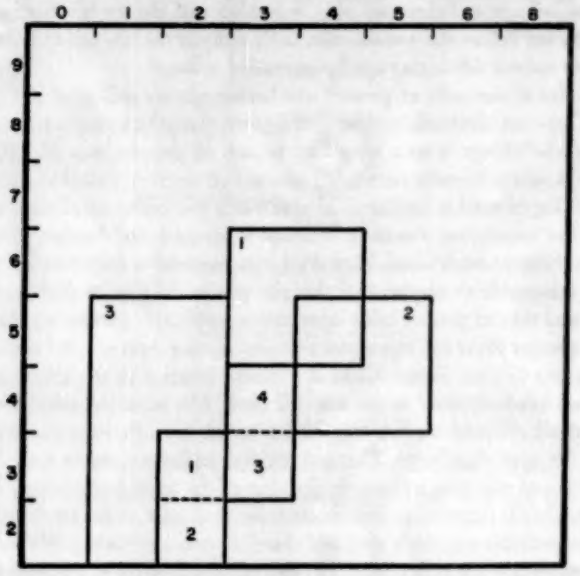

FIG. 6. Baja California: C-14 dated site: 10YR Hue. The large rectangles numbered 1, 2, and 3 are the same as in Figures 4 and 5. The small squares numbered 1, 2, 3, 4 refer to different levels in the midden. 1 is the 0 to 6 inch level; 2 the 6 to 24 inch level. These are in the upper, loose dark midden. Squares 3 and 4 refer to the lower older midden and indicate that it becomes lighter with depth. The 2500 year determination refers to the base of the upper midden.

dated by C-14 in Baja California. A loose unconsolidated, virtually unweathered, shell midden has been dated by C-14 at the twenty-four inch level as 2500 years old. The color is very dark grayish brown over a very dark brown. The underlying midden is consolidated, shells are weathered, and the color is dark brown. These values are shown in Figure 6. They show a similar shift in color as the Rose Canyon middens. As brought out in Figure 1, this shift is toward the kind and degree of soil color normal to soils weathered under segments of Wisconsin weathering-time.

The soil material in this case started abnormally dark and heavily loaded with such chemicals as calcium carbonate. These conditions greatly retard soil profile development. An antiquity greater than that for a normal soil of this color is implied.

These data indicate for midden soils in this area a long period of darker-than-normal soils due probably to increased vegetative growth resulting from the accumulated nutrients and humus accumulation accompanying the high lime content. In time the soils begin to lighten in color, beginning with the surface horizon. As will be brought out below, the process eventually reduces the site soil to a normal soil, which then records advancing age by increasing redness.

Examples of site soils of greater weathering-age are indicated in Figure 4 by letters. These are distinctly redder and lighter than the young archaeologic site soils. Bayside Village is on a sixty foot terrace on the east side of Mission Bay. The area is rich in hearths containing manos and metates, flaked stone, and there is a sprinkling of marine food shell of which only the thick-walled clam shells have survived the weathering processes. The soil is compact and leached so that a pH profile has become established. Shot-sized iron concretions have formed in the soil. It seems reasonable to assume that this site was in the past as dark as the young site soils and that its present color represents significantly greater weathering-time. The Sweetwater River site represents a similar terrace location, and the occupation record is very similar. Sunset Cliffs is a hearth location in the alluvium over the Pleistocene beach exposed in the sea cliff here. The recorded soil color indicates the loss of all effect of the human addition to this spot. Perhaps the Rose Canyon figure is the most significant. This is a midden, and there can be little doubt that its condition at one time was much like that of the overlying midden. Its present condition (hard, clayey), as well as its color, indicates much weathering-age. In view of its probable originally enriched chemical state and consequent retarded rate of development, it seems probable that this midden belongs in age with the terrace soils and records a large part of all Wisconsin weathering-time. Nothing is known of its archaeologic content.

Certain variables enter this work. When data obtained in the field were plotted, it was found that they differed systematically from the laboratory data. This is shown in Figure 7. (See Table 12 for the data.) The archaeologic sites score distinctly redder than the framework built on the laboratory observations would lead one to expect. The conditions of observation were entirely different for the two sets: full sun versus indoor north light, air dry versus field conditions, lump versus "dust," different observers. It seems clear that these conditions have led to scoring one hue redder in the field than in the laboratory. This is verified in one case by samples scored both in the laboratory and in the field. (See Table 4, Numbers 12 and 13.) The field values are 7.5YR hue while the laboratory values are 10YR.

If this allowance is made, the record remains an interesting one, with an impli-

cation for some of the sites of much if not all of Wisconsin weathering-time. The Sweetwater River Mouth site is on a low (fifteen foot) terrace remnant whose natural soil is light colored in the A horizon and reddish in the clay B horizon. The shallow shell midden here has approximated in color and kind and degree

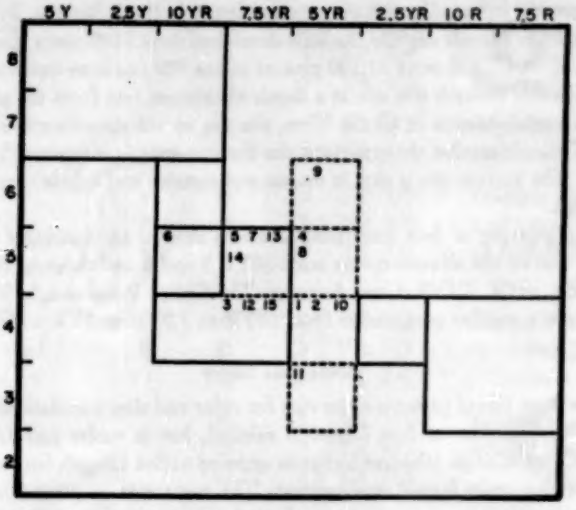

FIG. 7. Color determinations made in the field plotted on the same base as developed in Figure 1. The field determinations appear to be one hue redder than the laboratory data. (See Table 4 for descriptive data.)

of soil development this terrace soil. The Del Mar Fair Ground samples are also from shallow shell middens, and again by their reddish hues approximate terrace soils. The double adjustment of these samples must be remembered. It is assumed that they have passed through a dark, non-red, phase, and that they are over valued one hue toward the red scale. As noted for 4, 5, 6, these are a developed soil profile which has structure, particle size, and pH gradients paralleling the color changes.

For the Bataquitos samples, the color values for the adjacent natural soil are given for comparison. This site also has developed A and B horizons with pH and particle size characteristics that approach the natural soil. A lesser degree of development is expectable due to the retarding effect of the midden matter. The data suggest a terrace soil age for this site.

The lime-cemented base midden example from Bataquitos is on Eocene sands.

The development of a light colored A horizon over a darker B horizon reflects a weathering history similar to that of the lime-cemented middens on the Torrey Pines Mesa, also developed on cemented sands. The color difference is assumed to be due to the variation in scoring. The midden, above the service yard on the University of California campus at La Jolla, scored very dark. It has indications of a developing soil profile with clay accumulation in the B horizon. In degree of development, it exceeds slightly the soils developed since 7000 years ago on Santa Rosa Island. A C-14 date of 21,500 plus or minus 700 has been determined for a probable hearth beneath this site at a depth of thirteen feet from the surface.

At National Avenue in Chula Vista, the site on the sixty-foot terrace scored 7.5YR. This site overlies the gravels of the Sweetwater River reported[4] to contain artifacts. The surface site is rich in manos and metates and cobble core and flake implements.

A trial plotting of data from sand locations showed no significant difference. Sands in and on the alluvial covers score 10YR 5 and 6 and those on the terraces score in the 10YR, 7.5YR 5 and 4 square. The Crown Point sample is typical in that there is a regular progression from 10YR to 7.5YR to 5YR with increasing age.

Santa Rosa Island

Santa Rosa Island presents a test case for color and time correlations. The area is climatically similar to San Diego in rainfall, but is cooler and foggier, has slightly higher rainfall (thirteen inches as opposed to San Diego's ten) and in total is a somewhat more humid environment. The vegetation is grass. Topography, drainage, vegetation, accumulation and erosion processes are similar in the two areas. However, the abundant gypsum probably slows pedogenesis.

The island is remarkably like coastal San Diego county. There is a series of marine terraces below 300 feet, and broad gently rolling uplands of probable terrace origin above 300 feet. The low terraces have brown soils resembling those in similar position on similar materials at San Diego. The 300 foot and higher terraces have adobe soils where calcareous soft sandstones and shales are the parent materials, and red soils rich in iron concretions where sands are the parent material. The resemblances are precise as to type of soil at similar elevations on similar parent materials under similar present vegetation. These similarities probably extend into the past, since the two areas would experience comparable, though not identical, climatic changes during glacial pluvial times. Both areas retain evidences of coniferous forests; the rare Torrey pine being found in relict stands in both areas.

The samples from Santa Rosa Island are almost entirely from the alluvial cover

4 G. F. Carter, *Interglacial Artifacts from the San Diego Area* (Southwestern Journal of Anthropology, vol. 8, pp. 444-456, 1952).

TABLE 4

Field Data

Location	*Number in Figure 8*	*Horizon*	*Color*	*Notes*
Sweetwater		A	2.5 YR 3/4	Natural soil
River Mouth		B	5 YR 3/3	Natural soil
	1	B	5 YR 4/3	Midden
Del Mar Fair	2	A	5 YR 4/2	Superimposed
Ground	3	B	7.5 YR 4/4	middens
	4	A	5 YR 5/3	Midden with
	5	B	7.5 YR 5/4	a pH gradient
	6	C	10 YR 5/4	of A 6, B 7, C 8
Bataquitos				
Lagoon. Site	7	A	7.5 YR 5/2	Site soil with
at county road	8	B	5 YR 5/3	developed profile
crossing		C	10 YR 8/6	
		A	5 YR 5/3	Adjacent
		B	5 YR 4/3	natural soil
		C	7.5 YR 5/6	
Bataquitos				
Lagoon. Site	9	A	5 YR 6/1	Lime-cemented
on north side	10	B	5 YR 4/2	base
U. C. Campus, La Jolla, north of service yard	11	B	5 YR 3/2	
National Ave.,	12	A	7.5 YR 4/4	
Chula Vista	13	B	7.5 YR 5/4	On site
		B	5 YR 4/6	Off site
S. San Diego	14	A	7.5 YR 5/4	Field
Bay, point	15	B	7.5 YR 4/4	
north of Rohrs				
			10 YR 4/4 and 5/6	In laboratory

and superimposed dunes at the northwest end of the island. A marine platform at about twenty-five feet above modern sea level underlies the alluvial cover. The alluvium includes many elephant bones. C-14 determinations indicate a time of 15 to 30 thousand years ago for deposition of the midsection of the alluvium, with the earliest alluvium being deposited on the marine platform at a time beyond

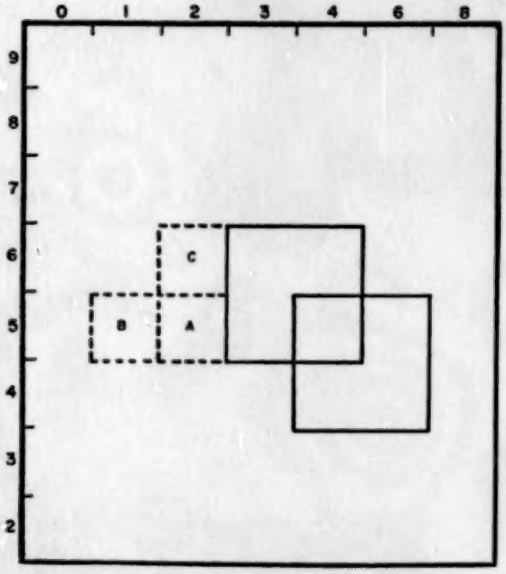

FIG. 8. Late Canalino site, Santa Rosa Island: C-14 dated at 1860 years: 10YR Hue. The boxes ruled in solid lines are the same as in previous figures. The low intensity of color expressed by shift to the left expresses the little weathering. This is also expressed by the proximity of the colors of the A, B, and C horizons. Compare the increasing spread with increasing time in Figures 9, 10, and 11.

the C-14 range. This is then a Wisconsin-age alluvial cover exactly comparable to the similar formation at La Jolla.[5]

The cover is not simple, but just as at La Jolla, there are obvious cycles of deposition, erosion, and weathering. Toward the top of the alluvium, there are two superimposed clay-pan soils. The clay is very dark, exceedingly sticky when wet,

5 See G. F. Carter, *Evidence for Pleistocene Man in Southern California* (Geographical Review, vol. 40, pp. 84-102, 1950).

and crumbly when dry. Beneath the clay-pans, gypsum crystals have formed. A period of minor erosion has followed the formation of these clay-pan soils. The gullies then created have since filled up, apparently nearly simultaneously, with strong sand dune formation. Possibly the dunes blocked the gullies and caused their filling. This time period is fixed by C-14 as about 6000 to 8000 years ago.

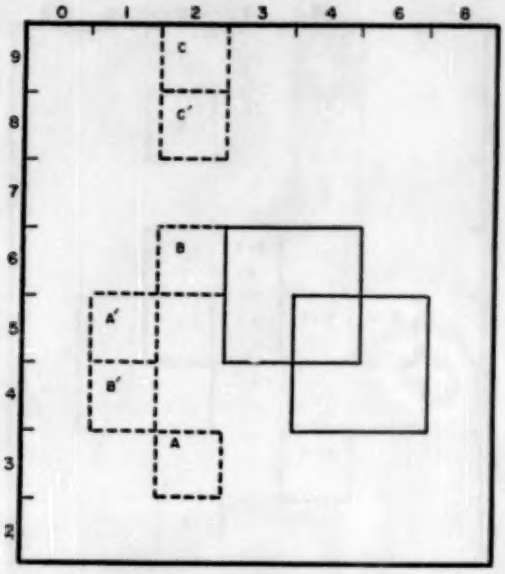

FIG. 9. Red Abalone sites, Early Dune Dweller (?), Santa Rosa Island: C-14 dated at 6-8000 years. Two sites near Arlington Canyon. 10YR Hue except for the C horizons which are 2.5 hue, but are plotted here in their appropriate positions to indicate the degree of color divergence from the very light-colored parent material. The difference in the two profiles of similar time level is a measure of differing weathering histories of the sites and is probably related to vegetation differences. The degree of color divergence from the C horizon material is related to the increased age. The color distributions are, however, still in the area attributed to young sites in Figure 4.

The parent materials here are similar to those at San Diego. The beach and dune sands are very light 2.5 Y 8 or 9 and the alluvium is darker 2.5 Y 7 or 6. The weathered alluvium shifts to 10 YR 5 or 6 just as at La Jolla. Materials of differing ages are plotted in separately in Figures 8, 9, 10, 11.

The youngest dated material is a Late Canalino site, dated by C-14 as 1860

years old. The striking thing here is that accumulation of midden material was at times so rapid that perishable materials such as sea grass were buried before they could rot. The succeeding nearly 2000 years have been too dry to supply sufficient moisture to rot this material, which now lies thirty inches from the surface. The very light color separation of the horizons is a measure of the pedologic youth of

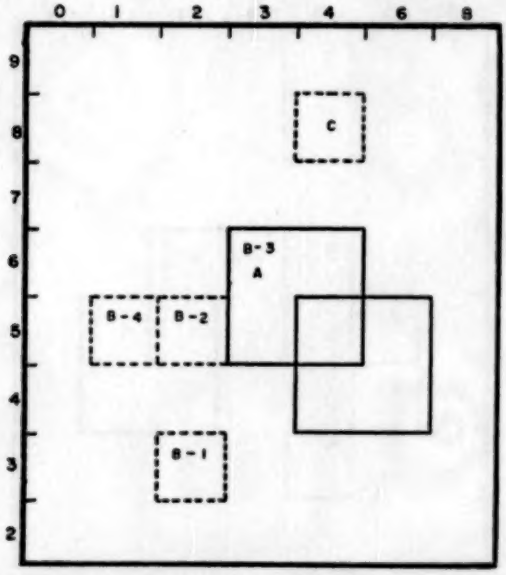

FIG. 10. Santa Rosa Island. Weathering profile in alluvium younger than 6800 years by C-14: 10YR Hue. The alluvium began with coloration indicating that weathered materials made up a fair proportion of the mass. A structural and color profile has developed. The most striking is the A, B-1, C differences. These are in the same direction and order but of a lesser magnitude than the late Wisconsin soils. (See Figure 11.)

this material. There is no compaction, slight evidence of lime migration, and in total, virtually no weathering visible.

There are two sets of materials that represent the 6000 to 8000 year time-level. Developments in dune sand are presented in Figure 9. Two sets of samples are scored. The parent materials for both are 2.5 Y 8 or 9. The color differentiation of the A and B horizons from the C horizons is an expression of the weathering. It is paralleled by slight compaction of the B horizon, with weak cementation by

diffuse calcium carbonate accumulation. The entire profile gives effervescence with hydrochloric acid. It is clear that very little leaching, cementation, and weathering, as expressed other than by color changes, has developed in this time period. This is in extreme contrast to sites in sands in San Diego where all of these measures are far more advanced.

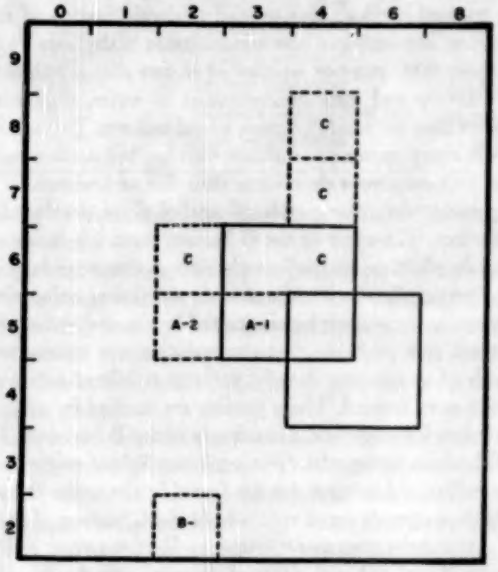

FIG. 11. Santa Rosa Island. Soil profile older than red abalone occupation of 6-8000 years ago. This represents a late Wisconsin weathering horizon. The degree of divergence of the A, B, and C horizons exceeds that of Figure 10 slightly but significantly. Other significant weathering measures, such as degree of leaching, clay mineral formation and so forth, indicate that the weathering-time separating this soil from the 6-8000 year soil is relatively large.

The 6800 year date was obtained from red abalones buried in the gullies cut through the strongly developed soils of the alluvial covers. The red abalone period apparently spans the 6000 to 8000 year period. These samples are comparable in age to the dune sand samples discussed above but represent weathering in alluvium. The pattern is the familiar one of light colored parent material that weathers to darker shades. (See Figure 10.) The familiar shift toward the red seems lacking here. This is probably due to the short weathering period, and to the tendency for

the clay B horizons developed in this alluvium to become virtually black here. Note the color of the B in Figure 11, for instance. The profile developed here represents something less than 6800 years of weathering of alluvium, for allowance must be made for deposition of twelve feet of alluvium. Since the landform became relatively stable, there has been sufficient weathering-time to create the color differences noted, to develop clear structural horizons, but not to develop readily distinguishable textural horizons, nor to lead to decalcification of the A horizon and upper B horizon, or to marked lime accumulation in the lower B horizon. This may represent about 5000 years of weathering in fine silty alluvium under conditions of good drainage and some concentration of water, suggesting a slightly wetter environment than the rainfall figures would indicate. This is a soil in earliest youth: it stands in sharp contrast to the soils with leached surface horizons, strong clay B horizons, with calcareous deposits in their deeper horizons.

Figure 11 presents the color profile of one of these developed soils on the alluvial cover surface. The color of the C horizon materials indicates either that accumulation of the alluvium was sufficiently slow so that considerable weathering occurred or that previously weathered materials were being redeposited. Since the alluvial cover contains many dark humic stained layers, and is distinctly separated into separate strata, it is probable that accumulation was intermittent, with considerable intervals of weathering. Finally, surfaces stabilized sufficiently that well developed profiles were formed. These profiles are marked by silty, light colored A horizons underlain by very dark, exceedingly sticky B horizons. The transition is sharp. The B horizon intergrades downward into lighter colored materials. Occasionally, iron pellets of bird-shot size are found in the upper B horizon, and as noted above, gypsum crystals occur regularly in the C horizon. The waters of the island streams are nearly gypsum-saturated in Summer now, and this gypsum crystal is undoubtedly related to this special chemical situation.

The Santa Rosa Island soils are of great interest in that they provide a dated series. From them, we gain a Pleistocene-Recent separation of type and degree of profile development that is important in validating earlier conclusions about the age of sites and soils.

Baja California

Observations in Baja California extended down the coastal strip from the American border to Punta Baja at 30°N, an airline distance of about 200 miles. In this distance the rainfall declines slowly from ten inches to below five inches. The climate is a fog desert. The vegetation is stunted chaparral with a rich ephemeral annual vegetation. The granitic peninsular range forms a central spine from which rivers descend to the coast. The coast is strongly terraced, just as at San Diego and on Santa Rosa Island. A major difference is found in the presence

TABLE 5

Alluvial Soil over Red Abalone Level Dated at 6800 Years

Soil Horizon	*Thickness*	*Texture and Structure*	*Field Color*
A	0-4	Loamy fine sand	10 YR 7/2
B-1	4-12	Loam	10 YR 5/3
B-2	12-28	Cubicle loam	10 YR 5/6
B-3	28-36	Loamy fine sand	10 YR 5/4
B-4	36-52	Massive hard brown fine sand	10 YR 6/3
C	52-64	Fine yellow sand	10 YR 8/4

of extensive young (Pleistocene) basic lava flows in Baja California. This introduces a differing parent material.

Nonetheless, similar soil relationships were observed. The low terrace soils are brown; the terraces about 300 feet have mima mound topography and adobe clay soils; and at high elevations red soils are developed both on sedimentary and granitic areas wherever ancient surfaces are preserved. The deeply weathered, sometimes very red soils, often with deep clay B horizons, are grotesquely out of place in the modern climate.

Samples scored in the laboratory are entered in Figures 12 and 13. The color distributions for fractions-of-Wisconsin and Wisconsin-or-more time are indicated. On these scales the 4000 year old dune sands, dated from shells in a hearth at a depth of five feet, score redder than the midden dated from both shell and charcoal at 2500 years. This is probably expectable on three counts: sands are precocious in early stages of profile development; there was less midden matter to slow development; and the age is significantly greater.

The midden, dated at 2500 years at a depth of three feet according to the published data,[6] is a source of confusion. In the field, it was thought that the dated level was thirty inches, but the data published by Suess gives a five to four foot depth. This would fall in the lower midden. The midden has two parts. The upper midden is black and loose, and the shells are fresh. The spaces between the shells are at times not yet filled with dirt. Its condition resembles the Santa Rosa Island site dated 1860 years, and a date of 2500 years is not unexpected. The lower midden is compact; the shells are slightly weathered; there is some lime migration; the soil color is outside the "young" midden range. It probably has considerably

6 H. E. Suess, *U. S. Geological Survey Radiocarbon Dates I* (Science, n.s., vol. 120, pp. 467-473, 1954).

greater antiquity than the overlying midden and its weathering must have preceded the deposition of the surface midden. If the surface midden belongs to the 2500 year level, the lower midden may have a modest antiquity.

One half mile north of China Point at Dr Hubbs' Station 19, a finely-made, square-based point was found in front of a hearth at twelve inch depth, eroding

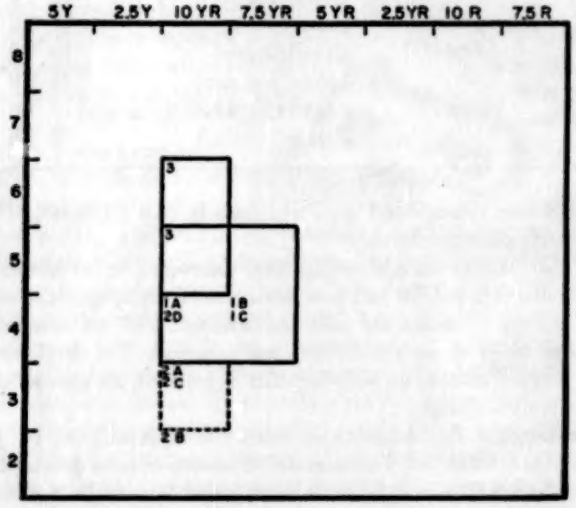

FIG. 12. Site soils from Baja California.

1. China Point, hearth in alluvium.

2. 2500 year site 2A and 2B refer to upper and lower parts of upper midden. 2C and 2D refer to upper and lower parts of lower midden.

3. Colors in sand dune containing intermittent occupation and dated at 5 foot level as 4000 years old.

out of the thin alluvial cover. The stratigraphy here shows a Pleistocene beach overlain by coarse conglomerates which grade upward into fine sediments. This material has weathered to reddish colors, 7.5 YR. Over this, there is a five foot thick layer of tan-colored fine silts containing a clay B horizon twelve to eighteen inches thick. A faint profile has developed in the alluvium over the clay-pan, and lime has accumulated in the top of the clay-pan. The hearth is associated with this phenomenon. The situation suggests an age and history comparable to Santa Rosa Island where alluvium younger than the Wisconsin age clay-pans has developed discernible soil profiles in the last 6000 to 8000 years.

Notes were made on the sites dated by Suess from samples collected by Dr Hubbs. The three hundred year old occupation near the top of the grade on the north side of Socorro Canyon is in thin brush and consists of scattered hearths with a sprinkling of shells and rare chipped stone. The surface inch of the sandy soil is dark and traces of hearth location can be made out. At San Antonio del

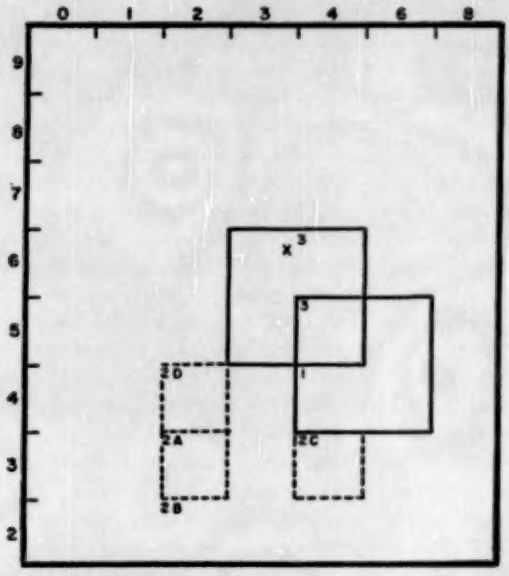

FIG. 13. Same site soils from Baja California as shown in Figure 12 but here plotted on the 10YR Hue. 1, China Point: only the upper midden is on the 10YR Hue. 2, 2500 year site: weathering of the surface of the lower midden (2C) is sufficient to suggest an age greater than for "Young Sites." In comparison with Santa Rosa Island this suggests more than 6000 to 8000 years. 3, 4000 year-dated sand dune.

Mar, the sites, in dunes immediately behind the beach, have been blown out. The individual sites are marked by clusters of rock, a mano or two, often an unformed and little worn metate, some percussively-broken rock. No sand-blasting of the stone work is noticeable. No trace of occupation stain is left in the sands. Conditions for sand-blasting are optimal. Similar sites on the Lake LeConte shorelines in the Colorado desert are distinctly sand-blasted. They must be considerably older than three hundred years and perhaps several times as old.

At Punta San Ysidro, a midden weathered to the maximum red of the natural soils was seen. This occupation must be fully as old as the oldest soil exposed on the lowest twenty-five foot terrace. South of Colonia San Ysidro, abandoned stacks stand near the edge of the marine terrace. There is occupation in the old marine caves in the stacks, and brown colored midden is dominant on the ocean front. The alluvial cover over the basic lava is only two feet thick. A residual soil of red color with silty sandy A horizon over a clay B horizon has developed. This is the fully developed Wisconsin pluvial soil. A bifacially-flaked cobble was found in this clay layer. The presence of an artifact within the B horizon suggests the presence of man prior to the development of the clay-pan. This developed soil is overlain by a double midden. The upper midden is twelve inches thick and brown in color. The lower midden is six inches thick and has a reddish tinge. The colors were not recorded in the field nor were samples taken. My impression is that the sequence is within the 10 YR-7.5YR range. The thin cover indicates uninterrupted weathering during Wisconsin time. The strong red coloring in this area is due more probably to uninterrupted weathering than to the basaltic parent material.

In general, these three areas are remarkably similar in terraces, alluvial covers, and soils. In all three, late middens are dark, not compact, show little or no lime migration or development of structural or textural horizons. Even color changes are slight in late middens (pottery period in San Diego and Baja California, and late Canalino on Santa Rosa Island). In San Diego and Baja California, there are adjacent middens that show varying degrees of lime cementation at the base up to the formation of calcareous hard-pans. There are also middens that have gone to brown soil colors, and in the San Diego area, some of these have developed textural, structural, and pH profiles comparable to the adjacent natural soils. The natural soils show a regular progression in degrees of weathering from the lower younger terraces to the higher older terraces. The type of soil profile development is similar in all three areas when the major soils forming factors are held constant. Similar soils form on nearly all materials in these areas. The major exception is the soft calcareous limey sandstones. These characteristically form dark clay soils. Nearly all other materials form soils with distinct horizons, with the A horizon being sandy, the B horizon clayey. This group of soils is normally lime-accumulating at depth. It shows regular shifts in pH and in color with increasing age. The color scale has been dealt with here. It is clear that the archaeological soils are following this geologic-pedologic color change scale, but are retarded. The denser the occupation, the greater the retardation. Thus, similar soil colors for habitation sites may indicate a minimum comparable age. On this basis, many of the site soils reported here represent weathering under segments of Wisconsin weathering-time, and some of them represent all of Wisconsin weathering-time.

A summary of the age and color relationships is presented in Figure 14. Time is placed on one axis and color on the other. Only one curve is drawn. Greater reddening is expectable in similar lengths of time in continuously humid lands versus areas such as Southern California where the Pleistocene record has been one of alternate wet and dry. Expectably, rates must differ from tropical to sub-arctic

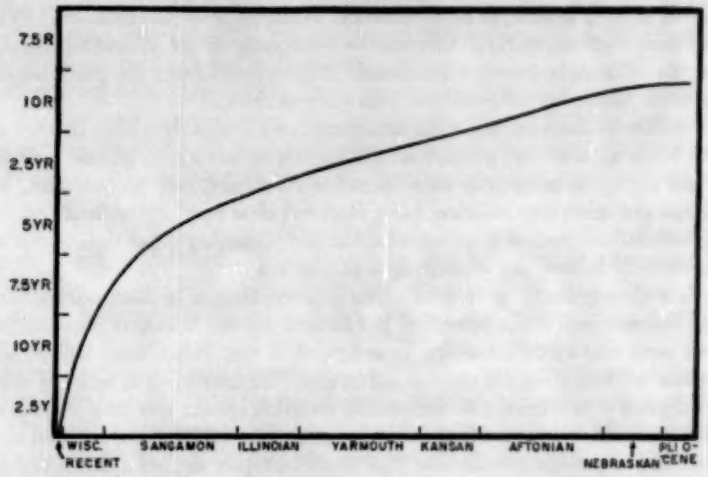

FIG. 14. Suggested rate of weathering soil reddening. The curve is derived from Figure 1. The axes are color versus geological time.

situations also. In the present state of our knowledge, it is the similarity of rate of change that is striking. For example, the soils of the central United States appear to follow this curve rather closely. The following citations are from Thorp, Johnson and Reed:[7] ". . . The soils that began to develop from non-red materials during middle and late Wisconsin glacial time lack the reddish hues. . . . The hues of modern soils developed in Wisconsin aged loess, younger than Farmdale, are nearly everywhere no redder than Munsell 7.5 YR and usually no redder than 10YR. . . ." The exceptions came from red parent materials. The buried Sangamon soils are Reddish Brown 5 YR 5/3-4 to 4/3-4 and strong brown 7.5 YR 5/6-8. "Probably some of the old, strongly developed Red Podzolic soils of the southern states may date back as far as Yarmouthian and Kansan times."

7 James Thorp, W. M. Johnson, and E. C. Reed, *Some Post-Pliocene Buried Soils of Central United States* (Journal of Soil Science, vol. 2, pt. 1, pp. 1-19, 1950).

My own observations are that the color contrasts between unglaciated Maryland and Pennsylvania and the glaciated regions to the north are sharp and show little or no relation to parent material. The soils developed on materials exposed since the late Wisconsin retreat are astonishingly shallow, light colored, and clay poor. In the West my observations are that the early stages of soil development on the Lahontan beaches are rapid and are unexpectedly close in process and product to the humid areas of the East and to the adjacent humid Sierra. Within the Sierra there are marked differences in weathering on the Wisconsin moraines and the Wisconsin moraines are greatly differentiated from the pre-Wisconsin moraines. Increasing red color is a most obvious change.

Carbon 14 dates are beginning to accumulate for soils. It is clear that we will soon know a great deal more about soil process in relation to climate, and rate of soil change in relation to such factors as color, pH, clay accumulation, and calcium carbonate accumulation. Long cherished ideas may have to be abandoned, and conclusions reached in an experimental and pioneering paper such as this will undoubtedly be modified as more data accumulate.

It is already clear that to some extent soils will have to be discussed regionally with limited comparisons between unlike climatic regions. The data presented here show some over-all relationships. It is expectable that future work will advance the task of developing the regional differences. The assembling of series of differing degrees of weathering in comparable materials should give us a weathering-time scale which can be calibrated at its upper end by C-14 and checked at its lower end by geologic correlations. This should be highly useful for dating archaeologic materials. With the recent determination that a number of archaeological sites are beyond the C 14 range, it is apparent that we are going to need such scales.

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A NOTE ON ZUÑI DEER-HUNTING*

ELSIE CLEWS PARSONS

DEER-HUNTERS would paint their face and arms yellow and white to look like deer, and in stalking the deer, they put the skin and antlers of a deer over their back and head, and took a stooping posture.

In stalking hunters would give the mountain lion *(hoktitasha)* cry, ho–o! –,[1] and the deer would stop running. The cry *(duwokya)* made the deer "nervous," and with the cry deer might be hunted without weapons. *Hoktitasha* is *tsaniakya.*

If a fawn is found alone its nose, tail, or ears are pinched to make it cry out and summon its mother.

After the deer is caught the hunter holds its mouth shut[2] until it dies, with the idea of keeping its breath *(piñan)* inside — "that makes the deer live again."[3] At the place of the kill a hole is dug and sprinkled with *klo'o* (hard), i.e. micaceous, hematite *(tsuhapa)*, turquoise, abalone, and *oneawe* (corn pollen). Over the hole the deer is placed. The rite is "to get deer again easily."[4]

Every morning while the hunter is away his wife would bring out an image of Mountain Lion and from the image, in the direction taken by the hunter, she would sprinkle a line of meal. She would present food to the image. On the return of the hunter, blood from the deer would be smeared on the mouth of the image.[5]

* This brief paper, found among the manuscripts of the late Dr Elsie Clews Parsons, was kindly contributed by Esther S. Goldfrank. Attention is also directed to comparable observances and mountain lion images in Esther S. Goldfrank, *Notes on Deer-Hunting Practices at Laguna Pueblo, New Mexico* (Texas Journal of Science, vol. 6, pp. 407-421, 1954), p. 415 f, and Richard B. Woodbury, *Prehistoric Stone Implements of Northeastern Arizona* (Papers, Peabody Museum of American Archaeology and Ethnology, vol. 34, 1954), p. 160 f. — Editor.

1 Hopi hunters do likewise.

2 Holding it into the earth, according to a Hopi informant.

3 A fairly plain reference to the belief that the deer becomes reincarnate. Cf. Washington Matthews, *The Night Chant, a Navaho Ceremony* (Memoirs, American Museum of Natural History, vol. 6, 1902), p. 7.

4 Among the Hopi the sexual organ is cut out, turned toward the sun, and on it turquoise and corn pollen deposited.

5 It is not clear to whom the image or images belonged, but I infer they were the fetiches of the *tsaniakwe* or *tuskikwe* society. There is a *na* (deer) *ettone* which is cared for by an old woman, but it has fallen into disuse. The chief or head *(mosona)* of the *tsaniakwe* was the father of the present head of the *ashiwanni* of the south (Okash). Since he was a *shiwanni*, one to whom all acts of violence are proscribed, Okash could not take his father's place as guardian of the fetiches, hence it was passed on to the old man's son-in-law, to Zuñi [the name of an individual]. Both he and his brother Leopold were initiated into the *tsaniakwe*, and Zuñi got possession of the fetiches which he seems to have thought of as a personal or family property rather than a society

On the return with the deer, the wife of the hunter sprinkles meal from the house door to the spot under the roof shrine (the *shalako teskwin*). A *mikyapani* or double ear of corn ("mother corn") is placed between the fore hoofs of the deer; blankets are put over the deer; the deer is "smoked"; and on it every one in the house sprinkles meal. Prayer sticks are planted before and after the hunt.

On the return home, meat from the deer is given away to anyone the hunter encounters.[6] Menstruating women may eat deer meat.[7] Food taken out by a hunter and brought back would not be eaten by his wife, lest, like the deer, she conceive twins. Were she to wave the food four times around a rung of the house ladder, she might eat the food with impunity. Two kinds of food are made for deer-hunters: *chuakinaowe* corn which is roasted, ground, roasted, ground, and a third time roasted,[8] and *he'palokya*, wheat soaked in water until sprouting, then left in the oven overnight, roasted, and ground.

property. Zuñi did not become *mosona* of the society. Kalawisi is today [ca. 1915] the *mosona*, and between him and Zuñi's family there appears to be some degree of antagonism.

6 Among the Hopi the first man to come up at the kill gets one leg, the next another leg, etc.; each man according to the order in which he comes up getting a piece.

7 With one exception there appears to be no taboo on menstruating women (*adukwe*, blood come out) at Zuñi. A menstruating woman will not dance because her participation would make the throats of the singing men dancers tire more quickly than usual. (For throat tire — *shoyelatenane* — dancers would eat dry chili, without bread.) I heard of one instance where a girl had been engaged to grind for the *uhuhukwe* society, but because she was menstruating, her mother kept her home — not on hygienic grounds.

8 This food — "hard to make" — is given also to *kyaklo*, the leading masked impersonation in the quadrennial initiation.

THE SUBJECTIVE ELEMENT IN ARCHAEOLOGICAL INFERENCE[1]

RAYMOND H. THOMPSON

WILLEY[2] has described the two large problem fields of archaeology as the spatial-temporal arrangement of cultural materials and the reconstruction of cultural and ecological contexts. He points out that archaeology already has the methods and techniques for the first of these. It is in the second that methodological explorations are necessary for it is here that the archaeologist operates by inference from the ethnographic present. There seems to be a healthy although sometimes overzealous appreciation of this need, but at the same time a surprising lack of interest in the equally important need for an examination of the conceptual tools for remedying the situation. This paper is a first step toward such an examination; it is an attempt to find out what an archaeologist does when he operates by inference.

There are two related procedures involved in the establishment of an archaeological inference. First, the material evidence must be examined for suggestions or indications that an inference is possible. But an indicated conclusion cannot be established as an inference until its probability has been tested. Thus, the second process consists of the introduction of the probative material which contributes to this evaluation. The first step is a recognition of the indicative quality of the evidence; the second a full utilization of the probative analogy.

THE INDICATIVE QUALITY

An indication is that quality of the basic data which describes their inferential possibilities. The recognition of this quality is the starting point for any inference, for it is the indication which suggests that the inference is possible. The ability to recognize the indicative quality of the data is therefore a first requisite for the archaeologist who hopes to reconstruct the context of the specimen which he recovers. This ability is of course subjective. It is often described as the "feel" which an investigator has for the material.

1 This paper was read at the 53rd Annual Meeting of the American Anthropological Association in Detroit, December 1954. It is a much abbreviated version of the introductory section of my doctoral dissertation (Harvard University 1955), *Modern Yucatecan Maya Pottery: a Study of the Nature of Archaeological Inference*, now in press as a Memoir of the Society for American Archaeology.

2 Gordon R. Willey, in Sol Tax, Loren C. Eiseley, Irving Rouse, and Carl F. Voegelin, editors, *An Appraisal of Anthropology Today* (Chicago: University of Chicago Press, 1953), p. 229.

The failure of archaeologists to define this individual sensitivity has caused other social scientists, and even some archaeologists, to seriously question its methodological validity. Attempts have been made to replace this subjective ability with more objective approaches. However, a devotion to objectivity cannot be substituted for the ability of the investigator to recognize that a certain cluster of the objectively described data is susceptible of yielding additional information.

Contrary to the folklore of the discipline, this sensitivity for the indicative quality is not an uncanny and inexplicable ability which only certain gifted individuals possess. Rather, it is the combination of the investigator's anthropological background or training in fact and theory, his archaeological experience which is often called familiarity with the material, and his intellectual capacity. It is the subtle combination of these three variables which makes the recognition of the indicative quality a subjective matter. This combination becomes such an intimate part of the individual archaeologist's analytical thinking that he is not conscious of the exact sources of the impression or indication that he expresses other than the cluster of data which initiated the indicative process.

The ability is therefore subjective or individual in that each investigator brings a different combination of skills to bear on any given problem. This does not mean that the ability to recognize the indicative quality is inexplicable, but it does mean that this ability is hard to define. It would be quite unnecessary to ask each archaeologist to set forth the details of his background, experience, and intelligence for the benefit of those who may wish to judge his work. It is not, however, too much to ask that he define the segment of the combination which contributes to a particular indication.

But as soon as an investigator begins to ask himself how and why he arrived at a particular indicated conclusion, he shifts from the indicative to the probative phase of the inferential process. This phase consists of specific statements of the evidence which enters into the substantiation of the inference. Some of them are explicit formulations of the indicative data; others are statements of entirely new material. In many cases the archaeologist would find it difficult to distinguish between the indicative material and the new evidence. In practice, the probative data represent a transition from the explicit declaration of the indicative background to the introduction of the new information, such that the documentation of the indicative reasoning leads to additional probative evidence. These observations parallel John Dewey's remark[3] on the conjugate relationship of the indicative and probative qualities of data, which I paraphrase: It is important that the material from which an inference is drawn should also be suitable as far

3 John Dewey, *Logic, the Theory of Inquiry* (New York: Henry Holt, 1938), p. 428.

as is possible to test the inference that is made, to indicate what new kinds of data are required, and to give some suggestion as to how they are to be obtained.

THE PROBATIVE ANALOGY

The archaeologist who formulates an indicated conclusion is suggesting that there is a correlation between a certain set of archaeological material objects and a particular range of socio-cultural behavior. He must test this conclusion by demonstrating that an artifact-behavior correlation similar to the suggested one is a common occurrence in ethnographic reality. What actually happens is that he compares an artifact type which is derived from archaeological data with a similar type in a known life situation. If the resemblance in the form of the two artifact types is reasonably close, he infers that the archaeological type shares the technique, behavior, or other cultural activity which is usually associated with the ethnographic type.

Thus the archaeologist proceeds from descriptive data to contextual inference by demonstrating the existence and validity of various degrees of relation of likeness. This similarity or parallelism of relations is called analogy. Archaeological inference is impossible without recourse to analogy.

It is of considerable theoretical importance to recognize that archaeological analogy is based on a comparison of abstractions rather than a resemblance between individual artifacts. In the translation of archaeological data into general anthropological terms artifacts are classified according to concepts which are designed to produce groupings of potential cultural significance. An artifact is not treated as an individual object but as a member of a group of objects called a type. A type, then, is an abstraction derived from a group of artifacts of similar form. The type, not the single object, serves as the basis for analogy.

Since the starting point of an archaeological analogy is an abstraction, it is a logical necessity that the other elements in the analogy be formulated as abstractions also. Thus, a type of archaeological objects must be compared with a type of ethnographic objects.

Just as the objects themselves, whether archaeological or ethnographic, are treated as types, so the associated cultural activity must be considered in terms of ranges and abstractions. The analogy cannot be established by invoking a single item of behavior any more than it can be based on an individual object. It can only be accomplished by the correlation of generalized ranges of behavior with types of artifacts.

Although a correlation between the artifact types and various cultural generalizations is the ultimate goal of an archaeological reconstruction the first inferences

must be based on technological generalizations. The material bias of the basic archaeological evidence dictates this technological beginning of the inferential construct. The technical and ecological factors which condition the properties, source, and availability of raw materials define a specific range of possibilities for the manufacture of a class of artifacts. These technological possibilities have to be evaluated in terms of the archaeological evidence in order to narrow the range to fit the individual situation.

However, the information which is abstracted in a generalization is useless for analogy until it is organized to emphasize its relationship to the archaeological evidence. The probative value of any generalization is a function of the closeness of this relationship. It is therefore important that these abstract summaries be stated in precise and carefully chosen language. Technical data especially must be well organized not only because they begin the inferential construct but also because the significance of much technological information is often not readily apparent. Whenever an archaeologist receives technical or non-cultural information from another discipline he accepts the responsibility for identifying and exposing its interpretive significance.

The results of an analysis of the raw materials from which a group of artifacts is made are usually presented in terms of the properties of the materials. These data, like any other kind of non-cultural information, must be related to the archaeological problem. The archaeologist must shift the emphasis from a description of the technical property to a statement of some use which man makes of this property. In effecting this shift he introduces a cultural factor.

This transition from a technological to a cultural orientation is a fundamental step in archaeological inference because it establishes a cultural context for all of the probative material. But, the mere demonstration that this context exists does not define the nature or closeness of the relationship between the probative generalizations and the indicative archaeological evidence. This lack of definition results in a serious restriction of the probative value of these generalizations. Failure to recognize that culture is but one of three elements present in all archaeological concepts is responsible for this situation. These three basic properties are space, time, and culture. Phillips and Willey discuss the importance of this combination to archaeological theory:

> It is impossible to imagine an artifact type or a cultural "unit" that is not defined with reference to specific forms and does not also have distribution in space and duration in time. However, though invariably present, these three diverse properties may and do vary enormously in proportion one to the other. . . . It becomes essential, therefore, in the definition and use of archeological concepts of whatever nature to

understand precisely what quantities of space, time, and formal content are involved in the mixture.[4]

These remarks have a particular significance for the related problems of the comparability of the ethnographic data used for analogy and the probability of the resulting archaeological inference. Both the indicative and the probative data are stated as abstractions in order to reduce all of the ingredients of the comparison to the same level of organization. But the system used to organize these data is also important. The abstractions must be formulated according to a single set of organizational criteria. Since the point of departure for the analogy consists of archaeological evidence, the same theory and system used in the arrangement of this evidence must be used in formulating the comparative generalizations. It is, therefore, not enough to demonstrate the cultural nature of the probative information. The spatial and temporal boundaries must also be clearly defined before the generalizations can be used to maximum advantage for analogy with archaeological material.

Thus the archaeologist injects a subjective element into his inferential reconstruction at least twice. The importance of the archaeologist's particular skills and views in the recognition of the indicative quality has been particularly emphasized. These same faculties are employed in the probative phase of the inferential process, first in the search for analogous data, and then in the demonstration of the nature of the relationship between this material and the archaeological evidence. In both the indicative and probative phases the archaeologist makes increasingly greater use of the subjective element as he attempts inferences into the social and mental associations of his excavated material.

The subjective element serves as a kind of common denominator for archaeological inference. The individual investigator with his unique combination of interpretive skills provides the only possible means for the reconstruction of the cultural context of an archaeological collection. The final judgment of any archaeologist's cultural reconstructions must therefore be based on an appraisal of his professional competence, and particularly the quality of the subjective contribution to that competence. Our present method of assessing the role of this subjective element by an appraisal of the intellectual honesty of the archaeologist who makes the inferences is certainly inadequate. But, there does not seem to be any practical means of greatly improving the situation despite the insistence of many of the

4 Philip Phillips and Gordon R. Willey, *Method and Theory in American Archeolgy: an Operational Basis for Culture-Historical Integration* (American Anthropologist, vol. 55, pp. 615-633, 1953), pp. 617-618.

critics of archaeological method. We can only hope for improvements in the methods of measuring the amount of faith we place in an individual's work.

Fortunately, intellectual ability and integrity are not the only variables in an investigator's approach to a problem of archaeological reconstruction. These native qualities cannot be properly exploited without a rich background in anthropological theory and fact and a reasonable amount of familiarity with archaeological materials. Consequently, the best course to follow seems to be a continuation of the educational philosophy that an archaeologist is a general anthropologist who happens to prefer to pursue the study of man through an analysis of the unique documents of past human activity which can be found in prehistoric rubbish heaps.

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AN ALLEGED CASE OF PRIMITIVE MONEY (NEW CALEDONIAN BEADS)

PIERRE BESSAIGNET

AT THE EXTREME SOUTHERN END of the Melanesian Archipelago is an island of peculiar shape. Long and isolated, it stands in striking contrast to its neighbors situated farther to the north. This island is the "Grande Terre," the island of New Caledonia. For a long time it has been the object of ethnographical observations.

The natives of New Caledonia are the Kanaka,[1] who resemble Melanesians in color and hair structure, but are more like the Australians in certain other respects. Their economy is a combination of fishing and yam-growing.

The Kanaka make considerable use of shells, primarily for bodily ornament, behaving in this respect like many other people throughout the world.

Work on the shells occupies a great deal of the natives' time. After gathering the shells and selecting the best, they scrape and polish them until they look like pearls. They then fashion these beads in strings.

The New Caledonians take the greatest pride in their beads, never missing an opportunity to exhibit them. They line them up on the ground and pass them around to each other, showing considerable emotion on such occasions. Closer inspection, moreover, reveals that the beads fulfill important social functions.

M Maurice Leenhardt has devoted the greatest part of his life to the study of the Kanaka and has written a number of books about them. He has described the use of beads with great care. Leenhardt does not hesitate to refer to the bead strings as "native money." He thus aligns himself with those ethnologists who see in primitive "valuables" an embryonic form of money. It is the purpose of this paper to challenge M Leenhardt's position. Though the discussion to follow will be restricted to the case of the Kanaka, I suggest that it may throw light on the role of so-called "valuables" in certain primitive societies.

I

Marriages figure prominently in the list of occasions noted for the use of beads. At these times they play a role similar to that of cows or axes among the Bantu.

1 The word Kanaka that I am here using is the New Caledonian's own tribal name for themselves. It should not be confused with the nick-name "kanaka" currently given by Whites of the area to all "natives."

When a Kanaka takes a wife, he must give a certain quantity of beads to the bride's parents. Quite unlike the Bantu bridegroom, however, he gets back an equal quantity of bead strings from his parents-in-law. Thus marriage among the Kanaka is an occasion for swapping[2] certain specific valuables between the kin of the two partners. The man and woman are in this matter on a plane of equality. This is made clear by the following remarks of Leenhardt:

> Marriages are, according to custom, exchanges of cross-cousins and are arranged between the parents during the early childhood of the parties involved. This inter-clan agreement is sealed by an exchange of two equal quantities of money [deux monnaies de longeurs rigoureusement egales]. If, later on, one of the parties breaks the engagement and cannot be brought back into line, this would be regarded as a damage that no money could compensate. The guilty party can of course return the money he has received, but the trouble will not be over until the injured party agrees to return the original gift to him. The two quantities of money forming together the core of the compact must be exchanged back, and this by mutual consent, so that the act of untying is accomplished. It is an act of liquidation and not of repayment which is demanded by the injured party.[3]

It appears, then, that Kanaka marriages are arranged during the years of early childhood in accordance with certain traditional rules, and that the swapping of bead strings between the two families serves as a means of sealing the agreement. Further, it should be clear that there is no question of payment here, as is strikingly obvious from Leenhardt's evidence: there is a *mutual* returning of beads when the engagement is broken. What shall we say about a type of money that is exchanged for more of the same except that it is not money at all? As Leenhardt says:

> Here the money functions as a symbolic and propitiatory object, upon which the work of manufacture has conferred its specific value, an object which represents concretely, and thereby maintains through social and family relationships, the rhythm of life.[4]

The transfer of beads is not confined to marriages, but is also to be found at births and funerals.

As soon as the child has come into the world, the maternal uncle is notified by means of a fine string of beads:

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2 By "swapping" (a word which I shall use throughout this article), I mean merely what occurs when A gives something to B and B then gives something to A, wholly apart from any economic interpretation or otherwise which might be applied to these acts. I am using the term, then, as a mere physical description without any intention of either implying or excluding some consequent interpretation either by the concept "exchange" or by some quite variant concept. Of course I am aware that "swap" is, in ordinary usage a synonym for "exchange," but the reader will appreciate my difficulties in finding a neutral term.

3 Maurice Leenhardt, *Notes d'ethnologie neo-caledonienne* (Travaux et Memoires d l'Institut d'Ethnologie de Paris, 1930), p. 47.

4 *Loc. cit.*

"The child is here," they tell him, "we thank you. For it is you who have brought him by originally giving your sister to be his mother. May his lungs be powerful and his ear keen. . . . May he become the one who will help us in fortune and misfortune. May he preserve our marriage alliances, our yams and taro fields, our hearthstones and our pots, our grasspatches and our shade-trees." The uncle replies to this sentiment with a little gift of money and then sets out for the village of his [new born] nephew. [Upon arrival] he blows in the baby's ear, thus giving him his breath, whose rhythm he then checks in the beating of his fontanelle.[5]

Just as there is a swapping of bead strings between the parents of the bride and groom at weddings, so now at birth of a child exactly the same procedure is transacted between the father and the uncle of the child. This is nothing less than the continuation of the alliance between the two families, since the child, at the same time that he is the son (or the daughter) of his father, belongs to his mother's family by the system of matrilineal descent.

Again, at the individual's death the bead strings brought by the uncle will be returned to the uncle's family.

When the nephew dies, his paternal relatives bring to the *Kania* [maternal uncle] a bead string called *Kunume* or the death-string. It represents the breath of the dead man and is properly the same string that the uncle or his predecessor has given at the moment of birth. Those who are bringing the money are in fear of the *Kania:*

"Here is your money. It is being returned to those who gave it originally. It is the dead man's money, the money you gave to him when he was born and which belongs to you because it came from you, the money of the death rattle that we are holding up here so that *he* can see it, he who now lives in the hidden place. Let, then, our obligations be ended."[6]

The uncle answers:

"We are receiving your money, your treasures . . . and then we scatter your food, the taros, and the yams, and we pick from the seaweed where the fish and eels live. . . . For him, to him, those things offered to his uncles, to him who is always in the forest."[7]

We find here neither money nor exchange. The beads are merely media of a symbolic system whose meaning remains to be seen. But it is clear that they have nothing to do with payment. Leenhardt's monetary interpretation is in flagrant contradiction to his own description of the facts.

There is one particular case which Leenhardt regards as offering strong substantiation for his "monetary" theory of the beads. This consists of those marriages which are not accompanied by exchange of cross-cousins. It should be emphasized that a marriage among the Kanaka occurs only in conjunction with one or more

5 *Loc. cit.*

6 Leenhardt, *Notes d'ethnologie,* p. 84.

7 *Idem,* p. 85.

other marriages. A given marriage is only one phase of a series of matrimonial operations. A man who marries into a certain family is expected to give his sister to be the bride of one of the men of that family. Thus marriages are always cases of swapping women. In principle, to get married, a man needs a marriageable sister. If the man lacks such a sister, he can still procure a wife by contributing a bead string in addition to the one ordinarily given. This extra string is regarded as a substitute for his sister. According to Leenhardt it is in this situation that the beads acquire a true monetary value.

> In those cases where the money is used as a substitute for the sister, it takes on in addition to its role as a life-symbol, one of exchange value. Besides the woman, it will be used to acquire certain objects the difficulty of obtaining which has led the natives to the notion of value, viz. jade axes, the silence of others, and magical power.[8]

And Leenhardt adds: "all other objects are obtained by barter."[9]

This whole interpretation is obviously based on a confusion. "All other objects" are acquired by barter. Let us admit that. But, from what we know from other sources about money, it is from the process of barter itself that we should expect money to originate. For money is nothing else than that particular commodity whose use has been generalized in barter.[10] In an economy which unlike our own is not based on an extensive use of credit, it is not conceivable that one commodity attains the status of money without itself being involved in direct exchange. Leenhardt lacks an adequate idea of what money is. Besides, the substitution of the beads for the sister is not enough to give them an "exchange value." To be the substitute for something is not ipso facto to be its value equivalent. To take the place of something is not the same as being exchanged for it. Indeed, it is its exact opposite.

To sum up, we can say that in none of the circumstances we have examined up to this point have the beads played the part of money. They fulfill, to be sure, a very important function, but this function is by its very nature extra-monetary. One can guess that this function pertains to the sphere of those relations of reci-

8 Maurice Leenhardt, *Gens de la Grande Terre* (Gallimard: Paris, 1937), p. 127.

9 *Ibid.*

10 ". . . When the division of labour first began to take place, [the] power of exchanging must have been very much clogged and embarassed in its operations. One man, we shall suppose, has more of a certain commodity than he himself has occasion for, while another has less. . . . In order to avoid the inconveniency of such situations, every prudent man in every period of society, after the first establishment of the division of labour, must naturally have endeavoured to manage his affairs in such a manner, as to have at all times by him, besides the peculiar produce of his own industry, a certain quantity of some one commodity or other, such as he imagined few people would be likely to refuse in exchange for the produce of their industry" (Adam Smith, *The Wealth of Nations*, Modern Library: New York, 1932, pp. 22-23).

procity which constitute the background of social life among primitive peoples, for Leenhardt himself adds:

> Thus in the emotional sphere we find three [different] usages of Caledonian money:
>
> 1. In the making of an agreement, the contracting of a marriage, or the settling of a dispute, the giving of pardon: strings of equal length are exchanged.
> 2. In the absence of a sister: money is given in her stead.
> 3. In cases of obligation, birth or death: money is offered to the keepers of life, the maternal relatives.
>
> The events of social life are understood in terms of these same [three] situations of obligation, agreement, or subordination, and money is used in like manner to reëstablish harmony and to bring difficult situations to a happy conclusion.[11]

We have now reviewed the cases of marriage, birth, and death. These are the outstanding events of social life. They mark the successive phases of the continuation of society. We still have to consider those more particular situations which go to make up daily economic activity. Perhaps here we will find the beads playing that expected monetary function which we have not yet discovered.

We find among the Kanaka, as would be expected, the problem of the distribution of the needed raw materials and finished products over the different parts of the island. One way of doing this is the *pire*.

> "*Pire*" [Leenhardt writes] is the native term . . . which refers to the process of exchange of food between the coastal dwellers and the mountain dwellers, namely the exchange of tubers . . . for crustaceans and smoked fish. . . . At the new moon, mountain and coast dwellers meet at a chosen spot in the valley. Each party puts down its respective burden, looks over that of the other party, chooses what it wants and sets out for home with a new load.[12]

Leenhardt does not hesitate to read into this situation a case of barter, in other words of exchange:

> This regular contact between coastal and mountain dwellers is the occasion for particular agreements between individuals who desire to procure objects they cannot obtain in their own districts.
>
> This is an anticipation of the village fair and market place. Both men and women participate.[13]

If we are to believe Leenhardt, the *pire* is an intertribal market at which the natives barter their products on an individual basis. It is the embryonic form of an exchange system.

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11 Leenhardt, *Gens de la Grande Terre*, p. 127.

12 *Ibid.*

13 Leenhardt, *idem*, p. 93.

If this were so, and if the beads were truly money, could we not expect them to turn up occasionally at the *pire*, as money has a way of doing at barter transactions in those societies where barter and the use of money both occur? But unfortunately the bead strings do *not* turn up at the *pire*. Therefore, on the hypothesis that the *pire* is an example of barter we can infer with considerable probability that the beads are not money.

But is it really certain that the *pire* is barter? Could not it be rather the Kanakan version of the Trobriand *wasi*,[14] an institution found, as a matter of fact among many non-literate peoples. The activities here carried out have nothing whatever to do with "exchange." Rather, each group simply collects the products of its respective labors and brings it as a *gift* to the other group. If this is the case, then even less would we expect to find "monetary" beads turning up.

Leenhardt has described the occasionally "silent" aspect of the *pire* in the following manner:

> If it happens that one of the two groups does not get to the meeting, the other group throws down its burden in the grass where the absent party will eventually pick it up. The latter will in turn leave their own packs. I have often marveled at the sight of these untouched piles lying by the side of the path.[15]

It ought to be noted that in this practice we find neither mutual comparison of exchange value nor bargaining. If we are looking for barter, exchange, and money, we can only say that we are still waiting to see a genuine case of any of these.

The Kanaka have a ceremony which is conducted every year in the autumn. It has a twofold purpose: to distribute the harvest and render homage to the tribal ancestors. This is the Caledonian version of the "great feast," an institution commonly found in many societies of this type. It is called *Pilu-pilu*. Leenhardt characteristically sees commercial transactions at work here. According to him the Kanaka use this occasion for the exchange of certain objects, the most "precious" of which they *purchase* with beads.

Two different sorts of things are exchanged at the *Pilu:* regional products and objects of value.

Thus the village of Canala is known for its bracelets, Huailou for its mats. When

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14 "The members of an inland village, where yams and taro are plentiful have partners in a Lagoon village, where much fishing is done but garden product is scarce. Each man has his partner, and at times, when new food is harvested and also during the main harvest, he and his fellow villagers will bring a big quantity of vegetable food into the Lagoon village, each man putting his share before his partner's house. This is an invitation, which never can be rejected, to return the gift by its fixed equivalent in fish" (Bronislaw Malinowski, *Argonauts of the Western Pacific*, Routledge: London, 1932, p. 187).

15 Leenhardt, *Gens de la Grande Terre*, p. 93.

the *Pilu* is held at either place, mats and bracelets are bartered between interested parties.

But objects of value, such as jade-axes, balassor,[16] aigrets, are not bartered, but are displayed . . . [prominently] at the end of the *Pilu*. These objects are acquired in return for Caledonian money-strings [monnaie caledonienne] of certain definite length and quality. This the only instance known to me of genuine purchase.[17]

The regional products, then, are *bartered*, whereas the "valuable objects" are *purchased*.

Leenhardt has made his points quite explicit. He speaks of "barter," "purchase," "money"; we are then in the realm of monetary exchange. Let us note in passing that Leenhardt, after having in several previous passages quoted spoken of money and purchase, now comes out with the remark that the *Pilu* is the *only* instance which has the character of "genuine purchase" ["l'aspect d'un veritable achat"]. Here is an additional inconsistency.

The operations described above are actually very far from having the meaning attributed to them by Leenhardt. The whole thing is really a matter of mutual gifts rather than of exchange. It is not inconceivable, to be sure, that the swapping of mats and bracelets occasionally takes the character of barter. This is irrelevant. On the other hand, giving bead strings and receiving in return axes or aigrets does not necessarily constitute a case of exchange. Even less must we postulate here a case of *monetary* exchange.

Jade axes are sacred objects. They were used as meat carvers in the good old days of cannibalism. They were also used as symbolical weapons to strike the sun during fertility rites. Therefore, they are not ordinary *tools* like other axes. This fact has great significance. The same may be said for the aigrets, which are also symbolic and sacred objects without practical use. They are worn only on ceremonial occasions.

I submit that this "exchange" operation is really to be understood in terms of the sacred character of the objects involved. Participating as they do in the same symbolic system and being identical in function, these "objects of value" are mutually substitutable. The use of the beads within the kinship system and the parallel use of the axes and aigrets in the ceremonial life makes them both part of the same universe of discourse. This universe is once more one of reciprocity and mutual giving, as in our previously discussed cases of marriage, birth, and death.[18]

16 Bark cloth known as *tapa* in Polynesia.

17 Leenhardt, *idem*, p. 94.

18 This distinction between ordinary artifacts and sacred objects occurs almost everywhere. A good example is Australia. ". . . For the Arnhemlander all material objects are divided sharply into two categories, those which are *mardai'inboi* or *yarkomirri* (sacred), and those which are *wakkinnu* (profane). Objects of the first class, called *mardai'inboi*, comprise all things entitled to

These very reasons which preclude a monetary interpretation of the use of beads at birth, death, and marriage ceremonies are, therefore, equally operative in the case of the *Pilu*. As a matter of fact, when all these activities are taken together, it will be seen that they comprise practically the whole of life in the culture. And from all these activities the use of money has been shown to be excluded.

We have now examined and disallowed most of the evidence offered by Leenhardt to prove that the New Caledonian beads are really money. One further argument of his remains. This is based upon the fact that there is an established rate of exchange for the beads and European money. Does not this fact, Leenhardt asks, make it self-evident that the beads are really money?

Let the following facts be freely admitted. French shopkeepers on the island indifferently accept either beads or francs, and monetary transactions of all sorts are regularly carried on in which the beads are exchanged for French money and vice versa.

Referring to this use of the beads, Leenhardt says: "[The bead string] is accepted today in purchases of small value."[19]

It is clear that the beads have here an exchange value. But let us note that it is "*today*" that this is happening. The beads have acquired in addition to (and possibly in spite of) their traditional usage, a monetary function which has been conferred upon them by colonial conditions.

To understand the true import of these facts one should keep in mind that the transactions in question did not originate among the Kanaka and even now take place only where the Europeans are concerned as parties.

What we are witnessing here is not the functioning of the Kanaka economy but its actual destruction in the process of being integrated into the world market. This situation is, of course, a completely novel one. One can hardly argue from the fact of the contemporary convertibility of bead strings with francs to the allegedly monetary character of the bead strings before the coming of the White man. These primitive bead strings have *become* money, and this at a very recent date.

The Whites from the very beginning have sought out the products of Kanaka

be termed *yarkomirri*, which means that they are sacred by reason of dedication to, or association with, a totemic ancestor or a clan totem. . . . To possess these objects [of the first category] carries prestige, and their *marr* imparts power and strength as well as *tjambalt* — hunting prowess, "good luck" in hunting, they make the hunter *mel kar kuluk*, far seeing, (literally: eye-clear). Such objects are given regularly to friends and to members of other clans, particularly to people who stand in the relationship of *wakku* (son, woman speaking: sister's son, man speaking) but although they carry the obligation to make heavy ceremonial presentations in return, any idea of straight-out exchange — in the sense of economic equivalence, of barter or trade, in connection with things that are *yarkomirri*, is unthinkable" (Donald Thomson, *Economic Structure and Ceremonial Exchange Cycle in Arnhem Land*, Macmillan: Melbourne, 1949, pp. 46-48).

19 Leenhardt, *Gens de la Grande Terre*, p. 121.

craftsmanship. They *bought* them from the natives, giving in exchange French money. How so if, as we claim, the Kanaka had originally no concept of exchange? Because they had learned that the Whites would give them coveted objects of European make in return for these odd pieces of metal. The accidental entrance of Kanaka products into White trade naturally gave them the character of exchangeable commodities, a character which had been wholly alien to them during the entire pre-White period.

Among the objects thus drawn into the White market we naturally find the bead strings. As soon as commercial pressure had led to the disintegration of the whole kinship structure of the tribe, the bead strings were no longer called upon to fulfill their traditional function as effective symbols of reciprocity relationships. Once their status as exchangeable objects had been established it turned out that the bead strings *now* fitted all the requirements of money. Consider: they were measurable (by length); they were countable (whether by string or by individual bead); they were physically divisible; they were preservable; and, because they were the product of considerable labor, they had, once transformed into exchangeable commodities, great value in small volume.[20]

Let us ask then: was this major transformation accidental? By no means. In virtue of the fact that they served originally as quantitative measure (in births, marriages, and deaths) they had to have the above-mentioned physical characteristics. But precisely these physical characteristics are essential in the case of money, because money too is based on quantitative measurement. What is in common, then, between the bead strings and money is not the *specific* nature of being money as Leenhardt imagines, but the *generic* characteristic of being a means of quantitative measurement. The transformation from one specific function to another only needed the juxtaposition and interpenetration of the two cultures.

Probably a good indication of the "transitional" (i.e. between non-money and money) status of the beads is to be found in the fact that, whereas the beads have a price in francs, francs do not have a price in beads. "Some European traders buy and sell Caledonian money at the rate of forty francs to the metre."[21] Hence it is not really proper at all to speak here of a *rate of exchange*, as if one were dealing with the currencies of two countries.

This traffic in beads actually extends to the making of counterfeit money.

20 ". . . Men seem at last to have determined by irresistible reasons to give the preference for this employment [money] to metals above every other commodity. Metals can not only be kept with as little loss as any other commodity, scarce anything being less perishable than they are, but they can likewise, without any loss, be divided into any number of parts as, by fusion, those parts can easily be reunited again; a quality which no other equally durable commodities possess, and which more than any other quality renders them fit to be the instruments of commerce and circulation" (Adam Smith, *Wealth of Nations*, p. 23-24).

21 Leenhardt, *Notes d'ethnologie*, p. 47.

European convicts sentenced to forced labor in New Caledonia have realized the advantages of possessing beads for their dealings with the natives. They have introduced a more advanced technique [of making beads] and have begun to turn out counterfeit [Kanaka] money made with a grindstone. One of these counterfeiters told me well before the [First World] War that he made a profit of four francs a day at this business.[22]

Here as elsewhere there is counterfeit money and counterfeit money.

When I was seeking enlightenment [about the bead-making process] many years ago, I met a freed convict who was working on helix stones with file and pliers and who had thus succeeded in turning out bead strings more regular than the traditional Kanaka ones. Sixty years ago Father Lambert . . . [reported the case of] a counterfeiter who was making bead strings out of fish teeth. These false beads were easily detected and [therefore] never gained any value. . . . [On the other hand] those turned out by our convict gained acceptance because, although produced by a more refined technique, they were made out of the same material as the real thing.[23]

In our own days, then, money has invaded the whole native society and the traditional system is on the verge of total disappearance.

The hard realities of European commerce in all its uniformity have penetrated to the most remote valleys.[24]

II

Having discarded Leenhardt's monetary interpretation, let us now ask ourselves what is the real function of the beads in traditional Kanaka society.

The vital clue is, I think, to be found in the tribal marriage system. Let us now examine more closely the structure of this system, whose essential details have been merely outlined in Part I of this paper.

As we have seen, the husband's family gives a certain quantity of bead strings to the wife's family, which in turn hands over an equal quantity to the husband's family. Let us not forget that this is a swapping of beads, and that this swapping of beads accompanies a swapping of women.

Who are the women involved? Let us imagine the case of two men belonging to two different kin groups. Each man must marry outside of his kin group. They will satisfy mutually each other's wants by simply marrying each other's sisters. In this way the men will carry out their duty toward their kin group (i.e. find husbands for their sisters) and provide wives for themselves as well. This is nothing else than what is conventionally known as "exchange of sisters" marriage.

This type of marriage is, of course, extremely widespread in primitive society. Levy-Strauss has recently suggested in his monumental *Les structures élémentaires*

22 *Idem*, p. 47.
23 Leenhardt, *Gens de la Grande Terre*, p. 121.
24 *Idem*, p. 94.

de la parenté that this was in fact not less than the universal form of marriage in primitive society, of which all the others are derivations. This contention is not of immediate concern to us, but what I do want to stress here is that the marriage system of the Kanaka is not in the least peculiar to them.

The compact by which two men agree to marry one another's sister is known as a *vibe*, a commitment which has consequence for all generations to come. The sons of the initiators of the *vibe* will also marry each other's sisters. The same will apply to the son's sons and so on. Thus in each generation we will have a marriage uniting bilateral cross-cousins: each man is expected to marry a woman who is simultaneously the daughter of his mother's brother and of his father's sister.

Leenhardt describes the marriage system in the following terms:

> The initial exchange [of sisters] between the two clans sets up a *vibe*. This term expresses the idea of mutual aid, of symmetry, of complementality, of alliance.
>
> Let the following table [omitted here] represent the [total situation resulting from the] exchange of sisters between Nerhë and Rheko. . . .
>
> We have at the beginning the *vibe*, the alliance between Nerhë and Rheko, the former from the Worm totem, and the latter from the Iule totem. They swap [Ils ont troqué] their sisters. If this were a mere bargain, it would not go beyond this point. But this arrangement is not a bargain. It is a commitment for the future, a social contract [un contrat social]. . . . The [female] child that each man has by the wife thus acquired will be returned back [in marriage] to the other kin group originally vacated by that child's mother; all subsequent vacancies will be filled in the same way, by alternation from one generation to the next for all time. Two clans are thus joined together to assure the perpetuity of each family.[25]

It should be noted that the bead swapping will occur not only at the making of the original *vibe* but also at each marriage in the succeeding generations.

Leenhardt sees in this marriage system simply a social relationship between groups, a "contract" between two kin groups; therefore he regards the beads as mere seals of alliance. This is essentially a "sociological" interpretation.

> . . . Because the bead strings serve as seals, the father giving his daughter in marriage is not content merely to receive a string, but proceeds to return a similar one.[26]
>
> The money is thus . . . a social link; it preserves the unity of clans allied by marriage and eliminates all occasions of dispute.[27]
>
> The money is the bond attaching a man to the land of his maternal relatives. It [is solemnly returned to] these maternal relatives, bringing them the last breath of their heir; it marks the alternation of life and death, the ebb and flow which characterize harmonious . . . social systems. It works, as one native remarked, like a needle which in the process of sewing a roof together, goes in and out among the straws, always carrying with it the bond to bind them together.[28]

25 Leenhardt, *Notes d'ethnologie*, pp. 69-71.
26 Leenhardt, *Gens de la Grande Terre*, p. 124.
27 *Ibid.*
28 Leenhardt, *Notes d'ethnologie*, p. 54.

The truth is, in my opinion, much simpler. The leading clue is to be found in the situation where a man is compelled by the *vibe* to marry a certain woman, but has no sister of his own to give in exchange.

In such a case, as already seen, he can substitute a bead string for the sister.

> It happens that the suitor who does not have a sister to offer in return for the wife he is taking away from her clan must give an unusual length of bead string. The money then assumes the role of substitute for the missing sister. "Let it be the woman who is sent to you in exchange, and let it lie down in her place and in the place of girls to come [en la place des jeunes filles dont nous nous occupons]."[29]

Now what does the native mean when he says "Let the bead string lie down in her place and in the place of *girls to come*"? *He means that the extra string thus received will entitle the receiving kin group to obtain extra women in future generations.* When inherited, the bead string will thus be advantageous for any men in the group who are lacking sisters. Such men will return the bead strings to the original kin group in return for wives.

The real function of the bead strings, then is to keep a tally. What is recorded is nothing more than the inequality in the ratio of the sexes within a given generation and the purpose of the recording is to compensate for this inequality through successive generations.

What the beads symbolize, therefore, is *use value*, not *exchange value*.[30] They do not represent the *price* of a woman (the so-called "bride-price"), that is her exchange value, but rather the *right to* a woman, hence her use value. (They are in a way like hat-checks permitting one to get one's hat back.)

What is this use value? It includes besides the sexual gratification involved, the children she will bear. Therefore, the bead strings have as an ultimate function *the equalization of manpower among the kin groups and so of the whole economic structure of Kanaka society*, with respect to both production and distribution.[31] We can now understand why the beads are always handed back and forth in reciprocal fashion (e.g. at marriages, births, deaths, etc.).

I have rejected the monetary interpretation of Leenhardt in Part I of this paper. It should be clear by now that by so doing I did not mean to reject all economic interpretation, rather to make possible an adequate one. This was the

29 Leenhardt, *Gens de la Grande Terre*, p. 124.

30 "The word VALUE, it is to be observed, has two different meanings, and sometimes expresses the utility of some particular object, and sometimes the power of purchasing other goods which the possession of that object conveys. The one may be called value in use; the other value in exchange" (Adam Smith, *The Wealth of Nations*, p. 28).

31 In using the word "function" I am of course referring to the actual results effected by the use of the bead strings, and not necessarily to the natives' explanations.

purpose of the last few paragraphs. If the theory offered is correct, it will be seen that the "sociological" interpretation (the theory of the "seal") which Leenhardt so inconsistently mixes with his monetary interpretation, collapses. For whatever function of sealing the beads have is itself derived from their economic — but non-monetary — function, that is their use as tokens in the regulation of manpower.[32]

Since theories offered by ethnologists to account for the role of so-called "valuables" in primitive society fall into either the category of "monetary" or of "sociological" interpretations, it is probable that our analysis of the application of these theories to New Caledonia makes them equally applicable to many other societies in which the distribution of women is intricately conjoined with the systematic giving of certain specialized objects such as beads, axes, cows, horses, etc. If so the alternative theory offered in this article might well be found valid for such societies.

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32 One can therefore see that Herskovits is wrong in all respects when he writes: ". . . Among such folk as the New Caledonians, what is called 'money' consists merely of valuables exchanged to regulate certain social situations and as equivalents for precious objects such as jade axes, 'all other goods being obtained by barter'." "The difficulties of classification here are obvious: the impossibility of discovering the actual role of these different types of tokens — some never seen except by a few persons, and in an economic system where trading is predominantly by barter — renders judgment as to their economic function equally difficult" (Melville J. Herskovits, *Economic Anthropology*, Knopf: New York, 1952, pp. 258, 245).